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CONTINUANCE OF ARCTIC RESEARCH.

II.

Its Valuable Results, as shown in the Study of the Known Parts of Greenland.

In the article on the above subject in the number of the *Geographical Magazine* for Sept. 1877 (*page* 223), I pointed out that if the encouragement of maritime enterprise and the exploration of the unknown polar region were objects of sufficient importance to justify the despatch of an expedition to commence that work in 1875, those objects still exist. The great success of the Arctic Expedition of 1875-76, and the experience gained in it, furnish new strength to arguments in favour of further efforts; while the recent discoveries add fresh interest to Arctic research, and give additional scientific importance to its completion. We also recapitulated the rules for Arctic exploration which have been established by long experience, and showed that, in accordance with those rules, the next work ought to be the discovery of the northern sides of Greenland.

There is, I believe, nothing that is better calculated to produce a conviction of the usefulness of those Arctic expeditions of discovery which have redounded so much to the honour of our country, and have added so largely to the sum of human knowledge, than the contemplation of what has already been discovered in one division of the polar region, such as the known part of Greenland. Apart from the intrinsic interest of such a review it will show the objects of Arctic exploration generally, and the wide field of scientific study, in almost every branch of investigation, that it opens out; as well as the rich and fruitful results that have been, and yet may be obtained from it.

There is an area of many thousands of square miles within the Arctic Circle of which we are in total ignorance. There is also as vast a region respecting which our knowledge is limited, and where an increase of it is very desirable. But there are portions also where investigation has been going on over a long period, has been continuous for some time, and is now tolerably complete. It is to the partially discovered and examined part that most interest attaches. When the curtain is down and all is concealed, there is no food to keep imagination alive. But as soon as it has been partially withdrawn, the portion which is revealed increases the mystery that attaches to the still hidden parts, and gives full scope to a laudable curiosity.

In such a position are the wild lands discovered by the Austrians, between Spitzbergen and Novaya Zemlya, whose northern shores will some day reveal many of nature's secrets. With similar longing does the intelligent enquirer await the discovery of the north-east passage, of the untrodden Wrangel Land—occasionally seen but never visited—and of the region north of the Parry Islands. Above all do we seek for a knowledge of the northern and unknown half of Greenland; because the portion of that country which has already been revealed to us is so full of interest in every branch of science.

The vast extent of Greenland, which entitles it to be considered as one of the great divisions of the earth, gives it a solid claim to special attention. But it is the position it occupies which secures for it a peculiar interest. In the first place it embraces, owing to its great length, of probably 1500 miles, all the characteristics of three distinct zones—namely, the Sub-Arctic, the Arctic, and the Polar Regions. Secondly, its elevation above the sea produces those stupendous phenomena of illimitable glaciers and ice-streams, which can be studied in no other part of the world. Thirdly, its geographical position between Europe and America has given to investigations relating to Greenland ethnology, history, zoology, and botany, a special value and importance.

It is necessary for the enquirer into these interesting subjects to have the general and characteristic features of Greenland always before his mind's eye. This great division of the earth's surface is in the shape of a triangle, with its apex pointing to the south, and its hypothenuse almost entirely unknown. Its interior is also nearly a closed book to us; it is believed to consist of a vast glacier whence ice-streams find their way to the coast region. But the coast has been pretty thoroughly explored and examined on the western side, from Cape Farewell to Upernivik, a distance of about 800 miles, as well as along the western shores of the channels leading from Smith Sound; and from Cape Farewell to the Danebrog Islands, together with the coasts discovered by Scoresby, Clavering, and the Germans, on the east side. These belts of coast line consist of the most glorious mountain scenery—lofty peaks, profound ravines, long valleys, precipices and cliffs, vast glaciers, winding fiords often running a hundred miles into the interior, and innumerable off-lying islands.

The first subject of interest relating to this wild and beautiful land is the ethnology, the question of how and from whence its coast line was peopled. The

Innuit of Greenland, the small men and women with the oblique eyes, flat noses and straight hair of the Tatar race appear to have lived on those Arctic shores for many centuries, while it is clear that they originally came from some far distant Asiatic cradle. The Eskimo race is the most widely diffused in the world; it stretches over the northern shores of the two continents. Its wanderings must have been of marvellous extent, and when its history is unravelled it will reveal adventures of deep and romantic interest which are now faintly shadowed forth in a few dim traditions. Not only similarity in physical appearance but also in language identify the different tribes of the Eskimo race scattered over thousands of miles from Siberia to Cape Farewell.

In former years, and especially when I was serving in one of the searching expeditions for Sir John Franklin, I paid very close attention to the history of Eskimo wanderings, striving to find the clue which would disclose the road by which Greenland was peopled. I discovered that along all the shores of the Parry Islands, that great archipelago stretching along the northern border of America, and on a line extending from the northern part of West Greenland for several hundred miles in the direction of Siberia there were traces of Eskimo encampments of great antiquity and at very short intervals. Those desolate shores could not support human life for any length of time, but Greenland can; consequently, these vestiges proved that a stream of migration had, in remote times, moved steadily from Asia to Greenland on a line far to the north of the American coast.

I remember once when I was examining the shores of Griffith Island for traces of our lost countrymen I had been out for some distance on the ice to get a shot at a brent goose which I had marked down behind a range of hummocks. Returning to the land at another part of the coast I came to some shingly beaches raised one above the other. In walking across the highest terrace I found a long willow switch lying imbedded in the pebbles and covered with lichens; it was 3 feet 2 inches long. No such thing could grow within many hundreds of miles of the place where I stood; consequently it must have been brought there by some one who had marched for many hundreds of miles long, long ago. I looked about me, and there sure enough, within a few yards of where the switch was lying, were the circles of stones marking the site of an Eskimo summer encampment, but covered with lichens and of great antiquity. I found here two portions of the bone runner of a sledge and a piece of bone cut for use as a funnel to lead down melting snow into a pot or other vessel. Afterwards I found perfect winter huts on the coast of Cornwallis Island with stone fox-traps, stone lamps and graves. Subsequent expeditions found many more, and by collecting all their observations I made out a continuous chain of such vestiges from the westernmost extremes of Melville and Banks Islands to the Cary Islands, within sight of the coast of Greenland. The late Arctic Expedition has completed our knowledge of Eskimo wanderings towards the Pole.

The Icelandic Sagas point to the north as the direction from which the Eskimos first came to South Greenland, and this is confirmed by Eskimo tradition. There is one very remarkable piece of evidence which, if it is fully substantiated, will be conclusive on this point. In the old so-called "house places" in South Greenland, where arrow-heads and many other curious relics have been collected, iron of a kind never found in Danish Greenland has been met with. But the "Arctic Highlanders," an isolated tribe in the extreme north of Baffin Bay, had iron knives when they were first visited made from an ore full of nickel, which is met with near Cape York. The small rounded flakes of iron were fitted into a bone haft in a very peculiar and ingenious way, each piece of iron slightly overlapping the other, and the security of all depending on a pin at one end. These Cape York bits of iron are identical with the ancient relics of South Greenland; while the only iron there found is meteoric and would crumble into dust if an attempt was made to weld it into any shape. The people who used the iron discovered in South Greenland must, therefore, have originally wandered southwards from Cape York. Thus bit by bit will our proofs be built up of the direction whence the people of Greenland came. There is reason to think that they were *in* Greenland, at least in the northern parts, even before the arrival of the Normans on the coast.

From these ethnological speculations we turn to the romantic history of the colonization of Greenland by the Norsemen from Iceland, which would be little understood if the explorers of fiords and headlands had not discovered ruins and inscriptions which identify sites, and thus illustrate and make intelligible the ancient narratives.

This story of the ancient Norman colonies in Greenland is one of peculiar interest, both as it relates to the wild fiords and headlands on which settlements were formed at so early a date, and because it was from Greenland that America was first discovered.

In a monastery on Flatö Island, north of the Breida Fjord in Iceland, there was found a collection of manuscripts called *Flatöbogen*, from the place where they were discovered, which proved to be copies of ancient Sagas or narratives of the deeds of early discoverers and warriors. Among them was the Saga of Erik the Red, written in the 12th century. It tells how a Norwegian named Thorwald, with his son Erik, fled from Norway to Iceland in consequence of a murder; how Erik, surnamed the Red, was outlawed in Iceland for another murder; and how he then sailed away, with a few followers, to search for a new land which another rover named Gunbyörn had seen some years before, when he was driven out to sea to the westward. Erik set sail on this lonely quest; he found the new land, and passed two winters there. Then he returned to Iceland, and came with his ship into Breidafjord, calling the land which he had found "*Greenland*," because, said he, "people will be attracted thither if the land has a good name."

The Saga then relates how Erik the Red went to colonize Greenland with thirty-five ships from Breidafjord and Borgafjord in Iceland, but only fourteen arrived; and then follows an enumeration of the leading men who came with Erik, and of the settlements they formed. The date of this event is fixed by the statement in the Saga that it took place fifteen winters before Christianity was established by law in Iceland, in A.D. 1000. The first colonization of

Greenland consequently took place in the year 985 A.D.

Erik the Red, we are told, lived at Brattahlid, and he had three sons named Leif, Thorvald, and Thorstein, and a daughter married to a rich man named Thorvard who lived at Garde. Herzielf, another Icelandic Lord, went with Erik and settled at Herzielfsness, and the Saga narrates the events of an enterprising voyage made by young Bjorni, the son of Herzielf, to join his father. In this voyage the youthful Viking discovered the coasts of Connecticut and Massachusetts, of Nova Scotia and Newfoundland, before he eventually found the fjord on the Greenland coast where his father dwelt. This was in 986. Then Leif, the son of Erik, bought the ship from young Bjorni and made another voyage of discovery, and once more the American coast was visited. Other expeditions were undertaken by his two brothers; intercourse was kept up with Iceland and Norway, and in course of time Leif embraced Christianity and brought priests to Greenland. So the aged Erik and all the settlers were baptized. The Saga of Thorfinn tells us of other voyages to America; and from another source we obtain a list of the Greenland Bishops, accounts of voyages far to the north up Baffin Bay, and enumerations of Norman settlements on the Greenland coasts.

But these stories needed life to be breathed into them by the labours of explorers; and I have brought the Sagas and their contents to notice, in order to show you how much the historian is indebted to the exploring antiquary for importing living and breathing interest into his narratives. Without the interest given to the Sagas by the identification and description of the places they mention, which enable us to clothe the bare facts with surroundings of scenery, and to picture to ourselves even the dwellings and the churches of the Norman settlers, the stories they tell would be as dry bones without life or motion.

Modern explorers have thus given life and interest to the ancient Sagas. For centuries it was not known where the Norman settlements had been, and even expeditions were sent to the east coast of Greenland, which had never been settled, to seek for them. Patient research has at length established the sites of the Norse colonies, and the truth respecting them excites our admiration of the prowess and skill of the redoubtable Norman rovers. Erik must have first reached the east coast, where he found a barrier of impenetrable ice. He then sailed southward for 400 miles and rounded Cape Farewell, where again he would have to do battle with the ice-floes before he could reach the coast, and then he must have had a long and perilous search before he discovered the rare little patches of green valley far up the fjords, where the settlements were planted. For the Norse ruins are found in the very best and most fertile situations in all Greenland. No better localities for settlers have since been discovered.

The explorers of the present century have identified the abode of Erik the Red, which he called Brattahlid. It is a lovely spot on an isthmus between two fjords, where there are ruins and foundation walls of seventeen buildings on a pleasant grass-covered plain. Brattahlid means the steep side of a rock, and a smooth cliff has been used as one side of the principal building among the ruins. The other walls are over 4 feet thick, with interposed clay, and the interior of the house was 40 feet long by 20 broad. Near Brattahlid are the still more perfect remains of the Norman church at Kakortak, and other ruins identify nearly all the places of the Sagas. Then there are fragments of the church bells, and, above all, three Runic inscriptions on tombstones. One, near the old home of Erik, is of the 11th century, and bears an inscription to the effect that the daughter of Vigdis Mars rests there; another on the site of ancient Herzielfsness, near Cape Farewell, is to the memory of a forgotten Norman settler named Hrvar Kolgvimson.

The Norman colonies did not extend further north than 65°; but in the summer time the bold settlers carried on seal and narwhal hunting in the far north, and also went on voyages of discovery. In 1824 a Runic stone was discovered near Upernivik in 72° 55′ N., stating that three explorers named Erling Sighvatsson, Biarni Thordarsson, and Eindrid Oddsson erected a cairn and explored on April 25th 1135. Moreover, a letter has been preserved which gives an account of an expedition that penetrated an unknown distance further into the polar regions in the year 1266, under the auspices of some clergymen of the Greenland bishopric of Gardar. They sailed from a summer station called *Kroksfjardarheidi*, on the north side of Lancaster Sound; ran before a southerly wind for three days; and it was after returning for four days that they described an observation which, according to Professor Rafn, places them in 75° 46′ N. Four days' sail from such a position would have taken them a long way up Smith Sound. When we remember the small Runic stone, not larger than a hone, which was found near Upernivik, and the ordinary custom of the Norsemen to leave such permanent records, it will be seen that further research in the polar regions may well throw additional light on these romantic voyages of the Norse Vikings. I even believe that the late Arctic Expedition actually did find vestiges of a former visit of the Norsemen on Washington Irving Island, which is far up the strait leading from Smith Sound. In no other way can the two lichen-covered cairns discovered there be accounted for.

Surely in all this there is a wide field for further investigation; and the old Sagas, thus illustrated by modern research, throw a rich halo of romance over Arctic lands, while the heroes they celebrate are bright examples of courage and indomitable perseverance as discoverers. It is their love of adventure for adventure's sake which is so admirable, and in which they resemble our modern Arctic naval officers. In spite of dangers and hardships the Norseman of old, like the explorers of to-day, always longed to renew their efforts to achieve discovery.

We learn from a brief of Pope Nicholas V., written in 1448, that the Normans of Greenland had built many churches and a handsome cathedral, but that thirty years before, that is in 1418, the settlements had been attacked and destroyed by savages who left only a few survivors. This account is corroborated by Eskimo traditions.

So ends the story of the Normans in Greenland, and there was an interval of three centuries before another permanent settlement was formed on the shores of those lovely fiords. But the coast was visited by Frobisher and Davis, and afterwards by our countrymen in the Danish service, Hall, Knight, and

Cunningham; while Baffin was in two voyages, in the last of which, in 1616, he discovered and circumnavigated the bay which bears his name.

The modern explorer naturally takes a deep interest in reading of the grand exploits of his Elizabethan predecessors who, with such insignificant means, achieved such great results. Reaching the coasts of Southern Greenland was almost as hazardous and adventurous an undertaking for our ancestors as the attainment of the 83rd parallel is for the modern explorer, so great is the difference in the means and appliances. It is therefore with a feeling of reverence that we trace out the tracks of such men as Baffin and Hall and identify the positions of places mentioned in their narratives.

James Hall made four voyages to Greenland from 1605 to 1612, three in the service of Denmark and lastly with some English adventurers, one of whom was Baffin. In these voyages he explored the fiords and islands near the modern colony of Holstenborg, and his descriptions enable us to identify most of the places mentioned. The Danes had carried off some of the Eskimos by force with their kayaks, and when Hall landed on his last voyage he was recognised as having been with these aggressors. A brother of one of the kidnapped people came up and gave him a mortal wound in the side with a dart. This James Hall was an experienced pilot and a gallant seaman.

To me, and I think to most of us, there is a fascination in reading of the brave deeds, the anxieties, the wishes and hopes of these ancestors of ours who lived and worked so long ago, and each in his steadfast honest way strove to do his best to advance the interests of his country. Sometimes a person appears on the scene in whom one gets interested, and who as suddenly disappears. Such an one was Pilot Hall's "boy," named William Huntris, of Scarborough, who was with him in all his voyages, and who evidently had the makings of an able and fearless explorer. In Hall's first voyage we hear of this boy as receiving a wound in defending his master, in the second he was allowed 30*l.* for his skill in navigation, and in the fourth he was grown up and pilot of the 'Heartsease,' when he tenderly nursed his dying master after he had received his death wound. Hall was buried at his own request on one of the off-lying islands near Holstenborg, where no stone marks his grave, but he was the first Englishman who left his bones in Greenland, and the story of his death is told by his companion, the renowned Baffin. The 'Heartsease' parted company in a gale of wind on the voyage home and we hear no more of the faithful young Huntris, who drops altogether out of history. In August 1875 I was on several of the off-lying Greenland islands near the scene of Hall's death, and pictured to myself the sailor's funeral, with William Baffin of imperishable fame and the equally brave young Huntris mourning over the shallow grave.

It is the speculations respecting the first inhabitants, the romantic story of the Norman settlers, and the reminiscences of our own glorious ancestors, aroused by names of bays and headlands, which give such vivid interest to this western coast of Greenland. But this interest is immeasurably enhanced by the magnificent scenery, and by the unequalled grandeur of nature's work; which has been so exhaustively examined, so far as the coast is concerned, by the learned Danish naturalists.

It was in 1721 that Hans Egede, the apostle of the Eskimos, arrived in Greenland; and since his time the labours of Crantz and Graah, of Fabricius and Rink, and of many other eminent scientific Danes, have shown how vast a field of valuable research is afforded by an Arctic land, how useful are the results of such research, and how utterly incomplete would be our knowledge, in almost every branch of science, if the unknown polar regions were allowed to remain a blank. The Scandinavian kingdoms are richer in literary and scientific men of the first rank, in proportion to their populations, than any other European country; and one of the greatest services they have performed is to demonstrate the numerous valuable results to be derived from Arctic research.

It is to them, especially to Professor Nordenskiold and the geologist Helland, that we owe our slight knowledge of the Greenland interior—a vast region into which it has been found impossible to penetrate for any great distance. The native Eskimos have a superstitious awe of the ice-covered country, which is looked upon as the dwelling-place of monstrous and terrible beings. This interior, exclusive of the inhabited coast line with its deep fiords and lofty mountain ranges, covers an area of 320,000 square miles, the whole of which is one mass of glacial ice, with a few ice streams reaching the coast and breaking off in the form of icebergs.

Professor Nordenskiold, during his remarkable journey in 1870, has seen more than any one else of the marvellous Greenland glacier. The rocky region of the coast is bordered by an ice wall several hundred feet in height, which in many places cannot be scaled. One peculiarity, in which the Greenland interior differs from ordinary glaciers is the almost total absence of moraine formations. The surface consists of closely heaped ridges and pyramids of ice 40 feet high, with an inclination of from 20 to 30 degrees near the outer edge, but becomes smoother further inland, and is cut up by large bottomless chasms. There is a constant rise, broken, however, by occasional valleys, the centres of which are occupied by lakes and ponds during the summer; and innumerable rivers flow along the depressions.

On the surface of the inland ice there are no stones; but in all directions are vertical cylindrical holes a foot or two deep, nearly full of water, with a layer of grey powder in the bottom of each. This very curious powder is a sandy trachytic mineral, with a composition which indicates that it does not originate in the Greenland granite. Its origin is, therefore, an interesting problem. It may be meteoric, or more probably it comes from an unknown volcanic region far away in the interior.

This minute powder, together with a small brown *alga* which is found in it, is the most dangerous enemy to the stupendous mass of Greenland ice, many thousands of feet thick, and hundreds of miles in extent; for the dark mass absorbs a far greater amount of the sun's rays of heat than the white ice, and thus produces deep holes over its whole surface which greatly promote the process of melting.

The grandeur and lovely majesty of this region are most impressive. No living creature is seen; nothing but a white world supporting a blue vault, while from

far below there comes up a peculiar subterranean hum, proceeding from rivers flowing within the ice. This moaning noise is varied, at intervals, by loud reports like artillery, when a cleft opens in the surface. Here and there the white landscape is relieved by a well-defined pillar of mist rising into the sky, coming from a bottomless abyss, into which one of the numerous glacier rivers is falling. The vast roaring water-mass bores for itself a hole in the ice, probably all the way down to the rock beneath, a depth of at least 2000 feet.

Professor Nordenskiold penetrated over the inland ice for a distance of 30 miles from the edge, where he was 2200 feet above the sea; and the ice was still gradually rising to the eastern horizon.

The most wonderful sight is one of the glacier rivers, deep and broad, flowing between blue banks of ice to some vast abyss where the whole immense mass of water rushes down a perpendicular cleft into the depths below, forming a magnificent waterfall. A white pillar of mist rises up into the blue sky wherever these rivers disappear over the still bluer cliffs. Such marvellous sights as these can only be seen in the interior of Greenland; and if hereafter the dauntless explorers of unknown regions ever penetrate still further over the mighty glacier, in all likelihood still more of nature's wondrous secrets will be revealed, and sights of equal beauty and grandeur will be witnessed.

The drainage of the great mass of Greenland is partly provided for by the ice streams which, at certain points along the edge of the glacier, issue into the sea, and are broken off in the form of icebergs. These bergs, when in a massive form with a flat top, are about 100 feet high; and when they run up into peaks and ridges they often attain a height of 200 and even 300 feet; and eight times as much of the bulk lies below the surface. They burst asunder and are riven into pieces by the action of the sea, so that they are met with of every size and shape. The glacial stream slowly advances down to the head of a fiord and then out into the sea, where the buoyancy of the water has a tendency to raise the ice-tongue upwards, so that a high tide or any other slight additional movement will break off the outer end and form a berg. In 1875 Amund Helland, a Norwegian geologist, investigated the action of the inland ice on these ice streams. He has carefully measured the rate at which the ice streams are pushed forward from the interior towards the sea. He found one of them to be 300 yards in thickness and 3½ miles wide; and that it moved at the rate of 47 feet a day during the summer season, which is twenty times the velocity with which glaciers advance in the temperate zone. No motion of ice takes place without an accompaniment of water, which issues forth underneath it, and thus the drainage is mainly effected. On the west coast of Danish Greenland there are twenty of these ice streams or outlets, over an extent of a thousand miles of coast line, and the actual discharge has been calculated from the *data* obtained by Helland. But further observations are needed before there can be a complete solution of this as of many other problems in physical science.

The scenery in the neighbourhood of these ice streams is absolutely unique, and is surpassingly beautiful. One such view is obtained from the summit of a mountain called the Lyngmarkens-fjeld on Disco Island which overhangs the harbour of Godhavn. The blue expanse of the bay is dotted with innumerable bergs of all shapes and sizes, their dazzling whiteness contrasting with the deep blue of the sea. Far away the great ice stream of Jacobshavn is distinctly visible, whence the bergs were drifting in a continuous stream, first in one serried mass of white, then blue specks appeared in it, which got larger and larger until the blue prevailed with the white masses dotted thickly over it.

Still more magnificent is the scenery in the Waigat Strait, between Disco and the mainland of Greenland. I crossed this strait in an open boat, under sail, in the evening of the 18th of July 1875. It had come on to blow hard, with rain, and threatening dark clouds were banking up across the Disco mountains. The scene was indescribably grand and wild. An army of icebergs was drifting down the Waigat, and occasionally calving or turning over with a loud echoing noise. Some of them were of great height, with their pinnacles 300 feet above the sea, peering over the wild scud and mist. Now and then a gleam of sunlight brought out a peak of the Disco mountains in bright relief. The boat, under a close-reefed sail, scudded before the squall at a brave pace, breasting and dashing through the waves, while the white spray curled round her and flew from her bows. The spray also dashed wildly over the icebergs which were drifting down the strait, rising and falling on the waves, and occasionally coming into collision with a loud report. It was no easy work to steer clear of them, so thickly were they crowded together. In calm weather the scenery of the Waigat is different, but equally lovely. Icebergs rest quietly on the glassy surface of the sea, and the sharp serrated outline of the Noursoak mountains stands out in clear relief against the bright golden sky, while the precipices of Disco have a ruddy reflection on them from the midnight sun. There is certainly no better locality for studying the formation and movements of icebergs, which can be seen drifting in hundreds out of the glacier-discharging fiord, and floating in imposing masses down the strait, grounding and again afloat, calving with loud discharges like the roar of artillery, and breaking up with a noise like thunder.

Glacial action in Greenland is thus a study which offers the most interesting of physical problems for solution, while at the same time it presents the inducement of scenery which is surpassed in grandeur and sublimity in few other parts of the world. Another branch of physical research, namely that relating to the science of meteorology, is in some respects of very special interest as regards Greenland. In the first place there is a great difference between the mean annual temperature of the southernmost station at Julianshaab, and the northernmost at Upernivik, namely, 20°, the former being 33° and the latter 13°. But the difference between the mean summer temperature is only 10° (namely + 48° and + 38°), but the winter difference is as much as 27° (− 7° and + 20°). The great influence that currents of the ocean have upon temperature is strikingly illustrated in South Greenland, which has a comparatively mild winter like that of Norway, but an Arctic summer. The reason is that the current flowing from the icy sea down the east coast of Greenland is deflected by the Gulf Stream, and turns north-

wards along the west coast, thus lowering the temperature during the summer.

But the chief peculiarity in the climate of Greenland is the instability of the temperature in the cold part of the year. There is not only a great difference in the mean temperature of each month in different years, but sudden changes from the bitterest cold to a thaw often happen several times in one month. These peculiar and sudden changes from cold to heat take place all along the western coast of Greenland from Cape Farewell to Upernivik, when the winds come from the east or south-east.

This remarkable phenomenon has given rise to much speculation. Some old authors explain it by surmising the existence of active volcanoes, or even that there was a comparatively mild climate in the interior of Greenland.

The true explanation is that Greenland is surrounded by regions which, especially in winter, have extremely different temperatures. Towards the west and south-west, in Labrador and the Arctic western islands, there is intense cold; while towards the east and south-east the Gulf Stream preserves, even in mid-winter, a temperature in the Atlantic of 32° to 41° *Fahrenheit;* so that the air above it may generally be supposed not to be much colder than freezing point. As Greenland lies between such different climates, its own must necessarily at all times be dependent on the direction of the winds. All those which come from the east and south-east bring warm weather, although they have to make their way right across the interior glacier. Moreover, the south-east wind is not only a warm, it is also a very dry wind.

Captain Hoffmeyer, of Copenhagen, has pointed out the striking analogy between the warm and dry east wind of Greenland and the *föhn* of the Alps. In the Alps it sometimes happens that a gale of wind from the south rushes down the northern slopes. This wind, which is called the *föhn*, is (although it comes from a snowy region), unusually hot and very dry. But whereas this south wind blows on the northern side of the Alps as the dry and hot *föhn*, it appears on the southern side as a moist wind, often accompanied by a downfall of snow. The explanation is, that as the pressure of the air lessens upwards, and any body of air, forced to rise from the surface of the earth, is exposed to less pressure and consequently expands, while expansion is a process that consumes heat, the air is cold while it rises. So that when a south wind is forced to rise up the Alps, it arrives at the foot, coming from the Mediterranean saturated with moisture. During its rise it will be cooled to its dew point, and will, from that time, only lose ½° during every 180 feet it rises. When it goes beyond the mountain ridge the air current pours with great force through the Alpine passes down the northern slopes, and is heated 1° every 100 feet, becoming drier because it cannot contain much more moisture than corresponds with perfect saturation at the low temperature it had when passing beyond the ridge. In this way the curious qualities of the Alpine *föhn* are explained.

The characteristics of the Greenland south-east wind or *föhn* are just the same. The height of the Greenland mountains is at least 7000 feet, and by passing this ridge a current of air would, if it comes from the sea saturated with moisture, gain 18° in heat. Hence there is a great probability that the south-east wind of Greenland owes its high temperature to the fact that it brings air away from the comparatively warm Atlantic, and that this air must rise over a great height in order to reach the west coast. But there are difficulties in tracing the *föhns* of Greenland. Numerous observations prove their appearance on the west, yet they cannot be followed backwards to their sources by actual observation. But meteorology affords another means of determining the direction of air currents in places where there are no local observations, namely, by the application of the Buys Ballot law which asserts that the wind always blows in that direction in which it has a higher pressure on its right than on its left side, and that the more unequal the pressures are, the greater is the velocity of the air. It would, therefore, be sufficient for the purpose of proving a south-easterly air-current over Greenland to show that the barometer stood, at a given period, higher in Iceland than in Davis Straits. The greater the difference in the barometer readings the stronger and more decided would be the south-east wind blowing between the two places. This test was applied to one of the most unusual instances of a Greenland *föhn* that has ever been observed, which took place in the end of November 1875, and was of 20 days' duration. During the whole period the normal great cold of winter was broken by warm weather with gales from the south-east.

I have mentioned this phenomenon of the Greenland *föhn* as an instance of the very interesting investigations which the Arctic Regions offer for the student of meteorology, and to show how closely these Arctic problems are connected with general meteorological questions. Thus in this, as in other branches of scientific enquiry, polar exploration is essential for the completeness of our knowledge.

This is still more emphatically the case when we cast a glance at the contributions which Arctic research have made to the science of geology. In Greenland alone these contributions are of immense value; and the bare and rugged character of the coast offers unequalled facilities for geological studies. In the deep clefts riven through the Greenland mountain mass, the structure of the rocks is most beautifully displayed, sections being laid bare, sometimes 1000 to 3000 feet in height, with a length of many miles. The predominating rock is gneiss or granite with gradual transitions. The latter rocks are of rare occurrence. There is a bed of compact red sandstone of limited extent, at the head of the Igallikofjord in South Greenland; and in Disco and on the opposite mainland there is an overflow of basalt, overlying beds of sandstone and shale, including coal and other vegetable remains. The trap beds present the plainest indications of their igneous origin, and there is evidence that beneath them there are extensive sandstone and coal deposits, only the outer edges of which are visible. It has been ascertained that the coal proceeded from a previous vegetation in the same sites where it is now found. Trunks of tall trees, now converted into coal or fossil wood, are still standing upright with the remains of their roots inserted in the very soil that gave growth to them; while perfect impressions of leaves have been discovered in abundance in the surrounding rocks, together with fruits, seeds, and the remains of insects.

These forests could only have existed in a climate which now prevails in Virginia or California, while they could not have flourished in a locality where so much darkness prevails during the winter as is now the case in Disco. These facts have been, and will be the occasion of much important discussion before they are fully understood; and discoveries in Spitzbergen, as well as those made by the late Arctic Expedition, have increased the wonderful character of the problem to be solved and the quantity of material available for its solution.

Of great interest, too, is the study of the effect which the overflow of the trap, when in a molten state, has had on the coal which then took the place of the once beautiful forests. On bursting out the trap made its way through the country once clothed with trees and fern thickets, and the coal is distinctly seen to have been altered in various degrees by the heat from the melted masses. In one place a small trap vein crosses and spreads over a thin coal bed for some extent. The coal in immediate contact with the vein was found to be totally deprived of its volatile bituminous ingredients, and changed into coke. In another place a coal bed was found converted into anthracite. There are, I believe, no places where the actual effects of the outflow of igneous rocks in a molten state can be witnessed under such favourable circumstances as in Greenland, while the fossil flora is, for the reasons above alluded to, a subject which will long command the attention of geologists.

To the mineralogist, Greenland is interesting because here only is found the mineral called *cryolite*, which, owing to the discovery of a chemical process in 1856 by which it may be converted into soda and alumina, is of considerable economic value. It is only found in one spot in Greenland, called Ivigtut, where it does not occur in veins or strata, but is imbedded in the granite rock in one solid mass 400 feet long and 50 to 100 broad. *Steatite*, or soapstone, and *graphite* are also found in Greenland.

If we turn from the physical features of this remarkable country to its natural history, it will be found that here also it presents subjects of most interesting inquiry, from the human race to the humblest vegetable.

I have already referred to the deeply-interesting questions relating to the origin of the people of Greenland. The work of Dr. Rink entitled *Tales and Traditions of the Eskimo* shows that an attentive study of their language and folk lore furnishes important aid to such inquiries. These Eskimos are a very remarkable race, one which has found the means of subsistence from generation to generation under circumstances of greater difficulty than any other has ever been exposed to. In these latter years, it is true their continued survival, with a population of 9588 souls, is due to the aid and support they receive from the Danes. This help has had the inevitable consequence of destroying *self*-help; and if the Danes were to abandon their Greenland colonies, the Eskimos would soon disappear. Still this race *did* continue to exist for centuries with no aid but their own skill and bravery in hunting; and there is even now a single tribe, far to the north of the Danish settlements, which has an independent existence. The Eskimos are quite capable of acquiring the arts of civilization, they make good mechanics, and one young Greenlander with only the instruction that could be supplied during one winter at Copenhagen, has since managed a printing, lithographing, and book-binding establishment in Greenland without any help. The Greenlanders still retain their traditions, they are able now to relate them and even to explain them by illustrations carved on wood blocks, so that the careful study of their folk lore by Dr. Rink has been well repaid.

The natural history of Greenland has been exhaustively treated by many learned men, and has received, as it deserves, very close attention. Otho Fabricius, the Minister at Frederikshaab from 1768 to 1774, published a great work in 1780, in which he described all the mammalia and all the birds, while the number of fishes has been increased since his time from 44 to 78. The mammalia were not, again, described with any care until Dr. Robert Brown took up the subject in recent years, and his treatment is all that could be desired. It is only on the sea and in the narrow strip of land between the shores and the inland ice that animal life is met with. On the land the reindeer, the Arctic fox and the hare alone are found, only a single wolf having been shot in the memory of man. But the sea abounds in large mammals, in whales, seals and bears; and their range and geographical distribution are subjects which have been very carefully elucidated by Dr. Brown. All the mammals are Arctic-European, except the musk ox which is not met with in Danish Greenland. This great ruminant wanders along the shores of the most northern-known lands in the world. It is of American origin, but it was found by the Germans on the east coast of Greenland; and the course it took along the northern shore is one of the curious questions relating to the migrations of large mammals which await solution.

It is, however, the minute life of the deep sea surrounding Greenland which has been most perseveringly studied in recent times, by the use of appliances which were unknown in the days of Fabricius. The 49 molluscs of Fabricius have increased to 216 in the list of Dr Mörch; and while Fabricius enumerates 333 invertebrate animals belonging to Greenland and the adjacent seas, the labours of Lütken, Schiödte, Mörch, and of Mr. Gwyn Jeffreys have increased the number to upwards of 896.

Sir Joseph Hooker has shown how great an interest attaches to the botany of Greenland and to Arctic botany generally, especially with reference to the distribution of American and European types. Of the 207 species of Greenland plants, all are European except 11, and 57 are absent in Arctic America. There are special peculiarities connected with the Greenland flora. The flowering plants are nearly all natives of the Scandinavian peninsula, and there is scarcely any admixture of American types, which nevertheless are found on the opposite side of Davis Straits; while a large proportion of the Greenland plants are nowhere found in Labrador or elsewhere on the American continent or islands. Another very striking fact is that the part of Greenland south of the Arctic Circle, though warmer than that north of it, and presenting a coast line of 400 miles, has very few more plants. Still more curious is it that several Scandinavian plants not found in Greenland, are nevertheless natives of Labrador and the Parry Islands to the westward. There is yet another singu-

larity connected with the Greenland plants. Some of them, which are nowhere found on the opposite shores of Labrador or the Parry Islands or in Canada, reappear at considerable elevations on the White and Alleghany mountains. Dr. Hooker has observed that no other flora known to naturalists presents such a remarkable combination of peculiar features as this.

Sir J. Hooker has offered a solution which is not yet fully accepted. He suggests that the Scandinavian flora, which is one of the oldest on the globe, extended, during the warm period preceding the glacial, over the whole polar regions, including Greenland and Arctic America. On the arrival of the glacial period, this flora was driven slowly southward to the extremity of the Greenland peninsula in its longitude, and to the latitudes of the Alleghany and White mountains in their longitudes. The effect in Greenland would be to leave there only the more Arctic forms of vegetation, the rest being, as it were, driven into the sea. But the effect on the American continent would be to bring the Scandinavian flora into competition with the American flora that preoccupied the lands into which it was driven. On the decline of the glacial epoch, Greenland, being a peninsula, could be repeopled with plants only by the northward migration of the purely Scandinavian species that had been previously driven into its southern extremity; and the result would be a uniform Scandinavian flora throughout its length, and this an Arctic one, from north to south. But in America a very different state of things would supervene; the Scandinavian plants would not only migrate north, but ascend the Alleghanies and White mountains, and the result would be that, on the one hand, many Scandinavian plants, which had been driven out of Greenland, but were preserved in America, would reappear in the Parry Islands and Labrador, accompanied by sundry American mountain types. This hypothesis embraces all the facts, which point also to an ancient closer connection between Scandinavia and Greenland through intervening land now submerged.

The Greenland flora though scanty is very pleasant to the eye. Vegetation covers the ground in thick masses, forming turf in the level places, while it fills the chinks and crannies of the rocks and creeps over the surface of the stones, giving a bright appearance to a near view of the land in summer. The prettiest thing of all is the club moss, really a *Cassiope*, with its graceful little white bell-flowers like miniature lilies of the valley. With it are generally the dwarf willows and birches, and the whortle-berry with its red berry and glossy little leaves. As far as Disco, but not further north, there are beds of lady's-mantle and angelicas, and masses of holly fern; the erect red blossom of the *Pedicularis Laponica*, the orange *P. flammea*, bright little red and white saxifrages, the familiar dandelion, potentilla and ranunculus, the Arctic poppy, the sweet smelling *Ledum palistre*, and the showy purple blossoms of *Epilobium alpinum*. Here, too, are the salad-supplying plants, sorrel and scurvy grass, and in the far south the birches and dwarf willows rise to the rank of bushes.

Thus the study of Greenland botany, interesting in tself, derives special importance from the peculiar position of that great continental mass and from the hypothesis which its remarkable character has given rise to. Space will not admit of a more detailed reference to these and other points of interest. My object has rather been to touch generally upon the numerous branches of enquiry which must receive attention when an Arctic region such as Greenland is explored.

This then is the answer to those who raise the question as to the utility of further polar discovery. We have taken into consideration the results of such discovery as regards one polar land. We have shown that, for every enquirer, it has added to the sum of human knowledge as regards each branch of research. The ethnology, the history, the physical aspects of the land and ice, the geology, the meteorology, the zoology, and the botany—all are rich in new facts and in special points of interest. And this is not all. There are many questions, such as glacial action, the existence of ancient forests in a latitude where an Arctic night prevails, the Greenland föhn, the hypothesis of Sir J. Hooker respecting the botany and others, the interest of which is not confined to Greenland. They throw light upon general questions, and without the additional knowledge furnished by Greenland research there would still be darkness where light is now breaking. Thus the results of polar discovery, like all other knowledge, is not confined in its application to a locality, but gives material aid to general research, and its absence would cause a sensible loss. The same truths apply to the other Arctic lands, whether known or unknown. I therefore ask my readers to concur with me in the opinion that, as the knowledge which has already been acquired of Greenland is useful and interesting, so a similar knowledge of the *unknown* northern portion of that vast region would of necessity be also useful and desirable; and that the continuous prosecution of polar research is a good thing to be advocated at all fitting times for the sake of its rich and varied results in all branches of science, as well as for the encouragement of that maritime enterprise to which our country owes so much of its greatness and renown.

CLEMENTS R. MARKHAM.

AFGHANISTAN.

ABOUT the spring of the present year it was announced in some Indian and other papers that the Governor-General of Russian Turkistan proposed sending a "scientific" expedition into Afghanistan. Shortly after, it was rumoured in London that a publishing firm in the West-end had been commissioned by an agent of General Kaufmann to collect all available information regarding Afghanistan. The sudden intelligence of a Russian Mission, under General Abramof, having actually reached the capital of Afghanistan, about the beginning of August, may therefore be regarded as not having been without some premonitory warnings. It was followed up by an armed "demonstration" to the north of Afghanistan. The main body of the Russian troops, consisting of twelve battalions, besides Cossacks and artillery, were brought from Tashkend to Jam (about 180 miles from the Oxus); the right wing ascended from Petro Alexandrovsk up the Oxus to Charjui, and the left wing proceeded from Margilan in Ferghana to the Alai plateau, and then down towards the Amu. The urgency of the situation made the Government

MAP OF THE NORTH-WEST
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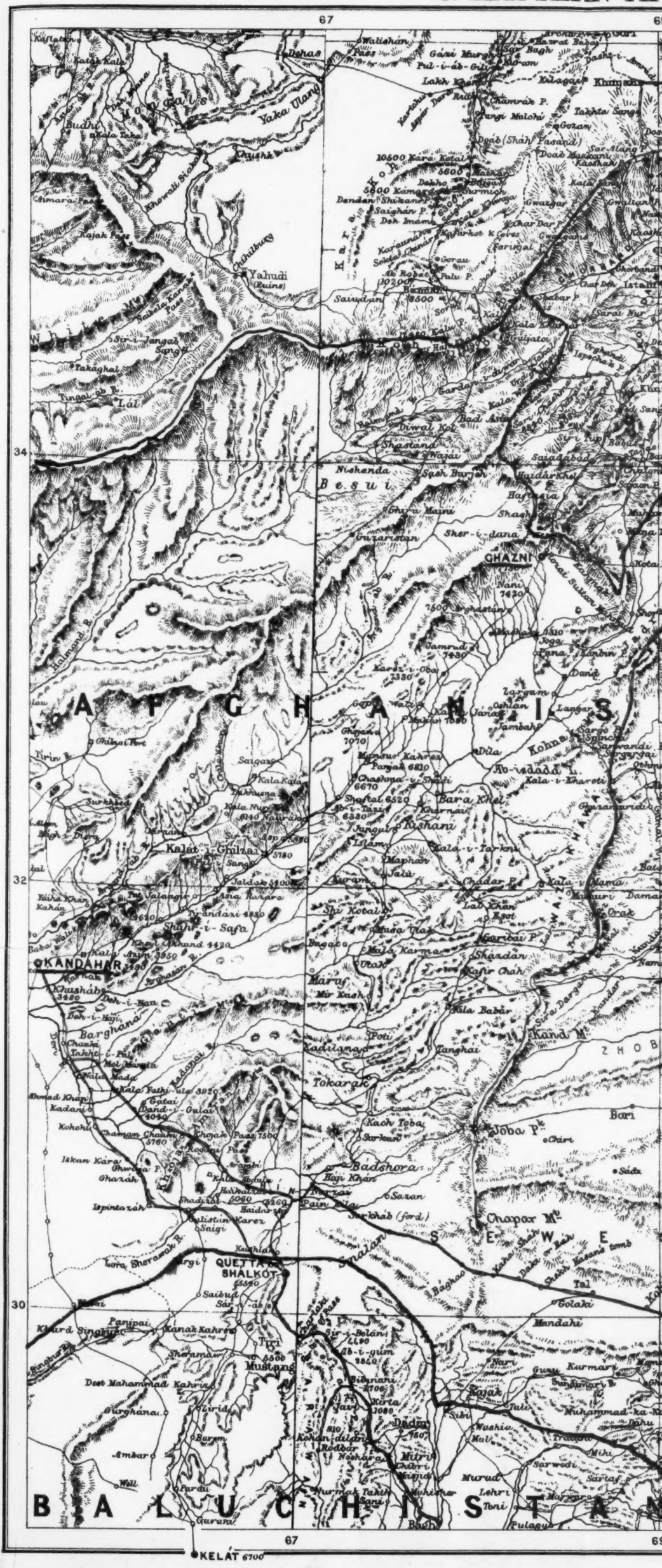
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Wajaz
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GHAZNI
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Jamrud 7430
Karez-i-Oba 7330
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Kalat-i-Ghilzai
Shahr-i-Safa
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Khushhab 3480
Barghana
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Helmand R.
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Ab-i-gum 3840
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Dadar 4560
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Shahr-i-Safa
Tirandari 4830
Kach Toba
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Khwaja Omari
Shahjui
Ghwaja Ghar
Ghwaja Amran
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Ghwaja P.
Gharáh
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Saigi
Kaghlak
Shadizai 5050
Baidar 5260
Dand-i-Gatai 4040
Kala Fathi 3920
Chaman Chauki 5760
Khojak Pass 7500
Roghani Pass
Kala Jangi
Kala Jalandar
Kala Ghilzai
Jaldak 5400
Ana Kanara
Kach-i-Akhund 4420
Kalat-i-Ghilzai 5180
Sangi
Kala Kaka
Kala Nurzai 6140
Yaur 6350
Sar-i-Dasht
Kala Zaka
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Yaka Ulang
Khwaja Omari
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Chihilburj
Sir-i-Jangal Sangar
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Kach Toba
Surkhab (ford)
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AFGHANISTAN

Geographical Magazine, October 1878.

Scale of English Miles.

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of India aware of the necessity of adopting some counter measures, and this led to the organisation of an English Mission, under Sir Neville Chamberlain, G.C.B., G.C.S.I., a general officer of considerable repute, who served in Afghanistan during the last campaign under General Sale, in 1841-2, and who is personally known to the Amir Sher-Ali. The scientific members, of whose appointments all readers of this Magazine must have been glad to hear, in virtue of their undoubted qualifications, were Dr. Bellew and Major St. John. The former accompanied Major Lumsden in his mission to Candahar in 1857-58; he took part in the Seistan Mission of 1871, to the scene of which he proceeded by land across Baluchistan in company with Major-General F. R. Pollock, and was also a prominent figure in the Kashghar Mission, under Sir Douglas Forsyth. The three works he has produced on these occasions—*Journal of a Mission to Afghanistan; From the Indus to the Tigris*, and *Kashmir and Kashghar*, combine both research and literary skill. Dr. Bellew is also a good Pushtu scholar, and the author of a Pushtu grammar and dictionary, and a Synoptical grammar and vocabulary of the Brahui language. Major St. John's name will be familiar to most of our readers as a valued contributor to these columns. He served in Abyssinia in 1867-8, and took part in the Seistan Mission in 1872, on which occasion his services, though but scantily recognised, were of the highest value. He is an excellent observer, and his exposition of the geography of Persia in *Eastern Persia*, and his map of the same country—the standard one in existence—has established his reputation as a geographer of no mean rank. It will be seen, therefore, that the scientific side of the present enterprise was not unworthily represented. In the face of recent events it is impossible to foresee whether this Mission will be suffered to advance or not. But as the political exigencies of the case are such that they must eventually bring Afghanistan into much closer communion with India, the present may not be an inappropriate time to glance at our existing knowledge of the country.

Afghanistan, in the geographical acceptation of the term, includes a vast area of country which owes to the Amir either a very slight allegiance or else none at all. In this wider sense it includes the whole of that mountainous region between the north-west of India and the north-east of Persia bounded on the north by the Oxus from the Khojah-Saleh ferry to its source in Lake Victoria, and on the south by Baluchistan. But from a political point of view the dominions of the Amir are much smaller, as over the whole of the country of the Yusufzae clans, of Kafiristan, of Chitral, of the Afridis and Vaziris, and much of the Hazarajat he pretends to exercise no sway at all.

Physically, Afghanistan consists of a star of valleys radiating round the stupendous peaks of the Koh-i-Baba and everywhere bounded by mountains of a very rugged and difficult nature. These valleys receive the drainage of a number of streams flowing in various directions, the more important among which are the Kabul river and its tributary the Kunar, the Argandab and the Helmand, the Hari-rud and the Murghab. Besides these, numerous smaller rivers drain the northern slope of the Hindu-Kush into the Oxus, others flowing in a uniformly south-western direction flow into the Seistan lake, while others, breaking through the Suliman chain on the east, carry the drainage of the table-land towards the Indus. Throughout its whole extent, Afghanistan is mountainous, and its general aspect is that of a series of elevated, flat-bottomed valleys with some cultivation in the vicinity of the streams and bounded by bare and bleak spurs. Yet scenes of great beauty are met with, the appalling grandeur of some of the defiles north of the Hindu-Kush are not surpassed anywhere, while the soft, still loveliness of many of the little sheltered glens on the southern slopes of that range are spoken of by travellers with rapture. The ranges in the north and north-east are well wooded with pine and oak. The general elevation of Afghanistan, starting from the Koh-i-Baba towards the table-land of Ghazni and the upper valleys of the Hari-rud, Helmand and Kabul river, is considerable. This elevation diminishes towards the boundaries of the country, and as its face becomes lower the rivers become absorbed by irrigation or lost by evaporation, and a belt of very barren or desert-like land is thus formed, bounding Afghanistan on all sides except in its north-east corner.

The most important mountain range of Afghanistan is the Hindu-Kush, a name applied to the whole line of Alpine watershed stretching south-west from the southern end of Pamir and representing the Caucasus of Alexander's historians. The spurs of this mountain chain run out on both sides into the basins of the Oxus and Kabul rivers. Its peaks, though as yet undetermined by the Indian trigonometrical surveyors, in all probability rise throughout to the region of perpetual snow, and the loftiest attain some 20,000 or 21,000 feet in height. This mighty range has formed in all times the chief barrier between the plains of Hindostan and their invaders from the north-west. It is pierced by upwards of twenty passes, of which, with the exception of the Hajiyak, Sar-ulang, Khawak and Chitral passes, we know but little, and which all lead from the basin of the Oxus into that of the Kabul river, of which the Hindu-Kush forms the northern limit. After running south-west for a distance of about 370 miles the Hindu-Kush bends suddenly westward, in which direction it continues for about 80 miles under the name of Koh-i-Baba, and then breaks up into three parallel ranges, which enclose the head waters of the Murghab and Hari-rud rivers. The northernmost of these finally loses itself in the sands of the Turkman desert; the middle one, Koh-i-Sufed, has a westerly and longer course, running north of and past Herat, where it turns northward and also merges into the desert, while the south range, Koh-i-Siah, follows a course pretty nearly parallel with the last-named one, and is supposed by most geographers eventually to unite with the ranges south of Mash-had—a theory which, if proved to be a physical fact would show an unbroken connection between the mountain systems of the Caucasus and the Eastern Himalaya. The southern spurs of this range give rise to the Kash-rud and Herat-rud rivers and to some feeders of the Helmand river. Near the point where the Hindu-Kush changes its direction from south-west to west, a saddle connects it with the Paghman range, which encloses the head streams of the Helmand and Ghorband rivers and runs south-west, forming the water-parting between the Helmand and Argandab and ceasing at their confluence. A

spur of the Paghman range runs eastward enclosing the source of the Argandab and thence extending parallel with the northern chain, bounding throughout its whole length the table-land of Ghazni and the home of the Ghilzaes in the north-west, and ceasing just north of Kandahar. The southern watershed of the Kabul basin is formed by the Ṣufed-Koh range, which runs due east and west, along the parallel of 34° for about 75 miles, when it splits into two ridges. This chain is said to be connected with the Hindu-Kush by the Attakoh range. The main range of the Sufed-Koh, which preserves a pretty uniform level of about 12,500 feet in height, is richly clad with pine, almond and other trees. Its valleys are said to present the appearance of a mixture of orchard, field, and garden and to abound in mulberry, pomegranate and other fruit trees. Macgregor considers that from this range there springs a ramification which runs generally south into the table-land of Kelat and the mountainous system of Baluchistan.

The Suliman range is the name applied by the best authorities to the range or ranges running almost due north and south along the meridian of 70° E. of Greenwich, from the vicinity of the Gamul pass to about the 29th parallel of latitude. Raverty describes it is as a mighty mountain barrier, containing in its northern section two ranges which increase in number as they run southwards, till at its southern extremity, where the Suri breaks through, there are no less than twelve distinct ridges "like battalions in columns of companies at quarter distance." The ranges increase in height from east to west; the highest called Mihtar Suliman or Koh-i-Siyah being snow-capped in winter. Major C. W. Wilson, C.B., in his recent ably-compiled map of Afghanistan, has adopted a similar view in his delineation of the Suliman range. Macgregor, however, holds a different opinion regarding this range. He considers that it springs from the Attakoh range, between Cabul and Ghazni, and, throwing out spurs to the east and west, proceeds southward without a break, forming the system of mountains of Eastern Afghanistan and Baluchistan. As a range running north and south along the meridian of 70°, he holds that the Suliman has no existence at all.

The opinion of the majority of geographers is, however, opposed to this view. One peculiar feature of this range is the manner in which it is pierced by a multitude of streams varying in size, which serve to carry off the drainage of the plateau-like country to the west. Where these break through the mountains a pass usually affords access from the valley of the Indus to the high table-land of Afghanistan, and Major Raverty gives details of no less than thirty-four (exclusive of small ones), between the Kaurah (about 31° 17′ N. lat.) and the Suri. The most important of these are the Saughar, Chachar and Suri passes.

The most important river of Afghanistan is the Kabul river (the ancient *Kophes*), which rises in the Unai pass near the source of its rival the Helmand, and receiving the drainage of the southern slopes of the Hindu-Kush on the left, and the northern watershed of the Sufed-Koh on the right, joins the Indus at Attok after a course of about 300 miles. Its largest tributaries are the Logar from the south, the Panjshir, Alishang, Kunar, and Lundai from the north, the Kunar or Chitral river being the longest of these. The lowest ford is a dry season one, just above Jalalabad, and from thence a favourite method of descent into the plains of the Punjab (especially when the Khaiber pass is disturbed) is by means of rafts on inflated skins. A marked change in the character of the Kabul river basin occurs at Gandamak (the scene of the massacre of the last survivors,—forty-five men and twenty officers,—of the disastrous retreat of the British from Kabul in 1842). Here there is a sudden descent from a minimum height of 5000 feet above sea level to one of 2000, and the change is well described by the Emperor Baber, who says of it:—"The moment you descend you see quite another world. The timber is different; its grains are of another sort; its animals are of a different species, and the manners and customs of its inhabitants are of a different kind."

Next to the Kabul river in importance, and probably exceeding it in volume as well as length, is the Helmand * (*Etymander*), which rises in the angle formed by the inclination of the Koh-i-Baba and Paghman ranges, and flowing first south-westerly, then westerly, and then north-westerly, for a course of altogether over 700 miles, discharges itself into the Seistan lake by several mouths. It loses its previous character of a mountain stream at Girishk, where it enters into a comparatively flat country and begins to be used for irrigation. The whole of the lower valley seems to have been once well cultivated, and the seat of a prosperous population. Ferrier considers that it has water enough for navigation at all seasons from Girishk downwards.

Other rivers of Afghanistan are the Kokcha (famous for its neighbouring mines of lapis lazuli), the Kunduz river or Akseria (both of these being tributaries of the Oxus), the Murghab, which rises in the Koh-i-Baba and Western Sufed-Koh and flows into the Kara Kum desert north-west of Merv, after a course of about 450 miles, the Hari-rud, or river of Herat, which, after a westerly course, diverges northward and breaks into two branches, the larger of which is supposed to lose itself in the desert beyond Sarakhs. The Khash-rud, Farah-rud and Harut-rud, which rise in the southern slopes of the Siah-Koh and flow into the Seistan lake, are all crossed by the different routes between Herat and Kandahar. The Lora, Zhob, Gomul, and Kuram are other streams of importance, the three last draining into the Indus.

Afghanistan and the adjoining tracts, which, though not politically subject to it, are beyond our frontier, make up a region which is still very imperfectly known. To the east, the valley of the Swat river has never been explored, while the valleys of the Chigar Sarae, the Alingar or Kao, and Alishang, comprising the country of the Kafars, are still quite unknown. There are several minor streams flowing down the slopes of the Hindu-Kush to join the Kabul basin, which deserve examination, as well as the various passes and routes above them, leading into the basin of the Oxus, a complete survey of which is very desirable on political grounds. Northward of the great range there is a large blank between the course of the Kokcha, explored by Wood, and the route between Khingan, Narin and Ishkamish, traversed by

* See our number for January 1874 for a monograph of this important stream.

the Havildar. Of the course of the Kunduz river, a stream probably not far short of 200 miles in length, but very little is known, and the same remark applies to the River of Balkh, which rises in the northern slopes of the Koh-i-Baba, and flows as far as Balkh, where it is used up in irrigation. Of the greater portion of the three ranges forming what is usually called the Paropamisus, or the western extension of the Hindu-Kush, our only information is derived from General Ferrier's narrative. Herat forms a centre from which routes radiate in all directions, intersecting one another freely, and it is only after we turn eastward that the scanty knowledge of the Farah-rud, Kash-rud, and the northern tributaries of the Helmand, all draining the southern slopes of the Sia-Koh, cannot fail to strike an observer. The interesting historical state of Ghor, whose monarchs once ruled over Khorasan, Afghanistan, Sind and Lahore, flourished here in the 12th and 13th centuries. The upper courses of the Helmand and the Argandab are almost entirely unexplored. There is a wide expanse of country (probably desert) from Kandahar southward as far as Macgregor and Lockwood's routes towards Nushki in 1877. This includes the valley of the Lora river, which from the Pishni valley to its mouth in the Lora Hamun is unknown, and greatly needs examination on account of the strategic importance of such a route should the river prove to reach the vicinity of the Helmand. The upper courses of the Arghesan and Kadani rivers are unknown, as well as the greater part of the Khojeh Amran range. Eastward there is an extensive and important unexplored region from the Gomul river southward as far as lat. 29° 40′ N., bounded on the east by the Suliman range, and on the west by about the 68th meridian of longitude. There are a few routes running east and west across this tract, but these afford no detailed topography, which is much required in view of its proximity to the British frontier. Northward of the Gomul there is also much to do in the way of exploration. It will be seen from the above that there is plenty of scope in Afghanistan for the explorer and geographer for some time to come.

The climate of Afghanistan is very diversified, but this is due to difference of elevation rather than of latitude. At Ghazni (7730 feet) the winters are most severe, and here, as well as in the Hazarajat, the people stay in their houses nearly all the winter. It may safely be surmised that above the height of 5000 feet the winters are intense. The summer heat is everywhere very great, except in the very elevated parts of the Hindu-Kush and other lofty mountains. During the summer a deadly hot wind blows over the south-western portion of the country, which is occupied by a sandy and almost uninhabited desert. Ferrier remarks that at Herat the wind blows constantly from the north-west, from the beginning of May till the middle of September, and with such violence as to prostrate houses, uproot trees, and cause much devastation. The province of Kandahar is subject everywhere to intense heat. For nine months the sun shines with the greatest possible splendour in Afghanistan, and the nights are even more beautiful than the days; travellers can journey in perfect safety by the brilliant starlight only. The same authority remarks that the atmosphere during the night is much charged with electricity, and the least friction will draw sparks from almost any object, with a slight cracking noise.

The geology of Afghanistan is but little known. Dr. Lord remarks that antimony, iron and lead are found in the Ghorband valley, and quarries of white marble in the hills near Maidan, which stone has been also worked at Herat from time immemorial. Bellew says that iron is plentiful in the Permuli district; copper specimens are found in various places, but the product is unworked; lead is obtained in tolerable quantity from the Hazara country; antimony largely from the vicinity of Kandahar; sulphur from Pir-Kisri, on the eastern confines of Seistan; and zinc and nitre from the Zhob valley and Herat respectively.

The main wealth of Afghanistan consists in the ordinary domestic animals, such as the horse, the camel—of a more robust and compact breed than the Indian type—the cow, &c. The first named forms one of the staple exports of the country. The horses known as Kabul horses in India are chiefly Persian, Turkman or Uzbeg, from Maimana and Mash-had, but there is a useful indigenous species called "Zaboo" or baggage pony—a hardy, active and stout animal of about fourteen hands, which is capable of much work. The breed of horses was improving rapidly under the Amir Dost Muhammad, who took much interest in it. Oxen are kept for ploughing, treading out the corn, and as beasts of burden, and the cows for the milk they yield. The sheep are entirely the fat-tailed variety, but of two kinds, with white and russet-brown or black fleeces. They form the chief wealth of the nomad population, and their wool is exported *viâ* Karachi and Bombay, to Bradford for broadcloth. Many of the wild animals, such as the wolf, fox, otter, squirrel, &c., are hunted or trapped for the sake of their furs, which are sometimes made up into clothing in the country or are exported to Russia.

The best estimate of the number of the population of the country rests entirely on a series of more or less rough estimates formed by different travellers. These, as collated by Colonel Macgregor, amount to a total of 4,901,000 souls.

The chief nationalities or tribes are the Duranis, the Tajaks, the Yusafzaes, the Ghilzaes, the Eimaks, the Hazaras, Kakars, Hindkis and Jats. The first named inhabit the country south of the Paropamisus between Kandahar and Herat. On the south and west the country is supposed to have been encroached on by the desert, judging from the presence of ruins and old accounts of the fertility of Seistan to which the country is said to have belonged. To the south-east the Durani country stretches as far as the Khojeh Amran range. The people are partly pastoral and partly agricultural, they acknowledge the supremacy of a sort of king or military autocrat, and number in all probability not less than 600,000 souls. The Tajaks are a race found all over Afghanistan. The word, though loosely used, is applied with most correctness to the inhabitants of countries speaking Turki and Pushtu, whose vernacular is Persian. They are a handsome race of the Indo-Germanic stock, and are probably the descendants of the Persians, who after the flight of Muhammad from Mecca mixed with their Arab conquerors and settled in Afghanistan. Their habits of life are settled, they are predisposed to

agricultural, mechanical, and commercial pursuits, and found in most numbers about towns. Their total number is estimated by Bellew at half a million. The Ghilzaes dwell between the Suliman range on the east, the Gulkoh on the west, the Kabul river on the north and Kalat-i-Ghilzae and Poti on the south. They procure their living by agriculture and pasturage, are the strongest of the Afghan clans and probably also the bravest, having, as it is said, been the first to attack us and the last to oppose us, which they did with great fierceness during the events of 1841-42. The old Arab geographers place in the Ghilzae country a people called *Khilijis*, whom they call a tribe of *Turks*, and to whom a family of Delhi kings belonged, but the identity of the two, though probable, has not as yet been satisfactorily proved. The Ghilzaes were supreme in Afghanistan during the beginning of last century and for a time possessed the throne of Kandahar. Lumsden estimates them at 276,000 in number.

The Yusufzaes occupy an extensive tract of hills and valleys north of Peshawar, including part of the Peshawar plain. Those beyond our frontier are independent and are noted, even among the Afghans, for their turbulence. They number about 400,000, according to Bellew. The Kakars inhabit an extensive tract of elevated country in the extreme south-east of Afghanistan. It is intersected by spurs coming down from the Suliman range, and is almost devoid of trees. It is almost wholly unknown; no European, with the exception of Lieut. Marsh of the Bengal Cavalry, having ever traversed it. The whole of the collection of the assafœtida gum from the wild plant, is in the hands of the Kakars. The Kizilbashes are a remarkably handsome, fair-complexioned and manly people, of Persian descent, whose immigration dates from the time of Nadir Shah (1737). They prefer the towns as places of residence, where they for the most part follow the occupations of merchants, physicians, scribes, petty traders, &c., and are justly looked upon as the more educated and superior class of the population. At Kabul they constitute the bulk of the Amir's cavalry and artillery, and many serve in the irregular cavalry regiments of the Indian army. The Hazaras number about 150,000, and they and the Eimaks dwell in the wild mountainous country on the north-west of Afghanistan Proper. This region is an exceedingly elevated one, ranging between 5500 and 10,500 feet. They have generally features of a Mongol type, often to a degree that might be called exaggerated, and authorities are agreed that they are mainly descended from fragments of Mongol tribes, who came from the east with the armies of Chinghiz Khan and his family. Leech says that they are called *Mughals* by the Ghilzaes, and there is further evidence of their Mongol descent. Their language is a dialect of the ancient Persian. The race has an evil reputation for the laxity of its morals, a charge which appears to be true, at least of the Jaguris—a powerful tribe of the Hazaras, dwelling between the head-waters of the Argandab and Turnuk. They are by no means remarkable for bravery out of their native mountains, and though they never pay tribute to the Afghan Sirdars willingly, they are generally coerced without difficulty by the firing of a gun, on the entry of the Afghan force. The chief articles brought by the Hazaras to market consist of the produce of their flocks, the woollen fabrics being the most prized on account of the fineness of the under wool of their animals. Their religion is the Shiah persuasion, and they consequently hold Afghans, Eimaks and Uzbaks in detestation for being Sunnis. The Eimaks is a name applied to a tolerably numerous people inhabitating the west portion of the Paropamisan mountains near Herat, to the governor of which the greater part of them are subject. Their origin is obscure, though originally they probably formed part of the same people as the Hazaras. Their country is reckoned as less mountainous than that of the Hazaras, and portions of it are cultivated and fertile.

The Hindkis or people of Hindu descent scattered over Afghanistan are occupied in trade, and do all the banking business of the country. The Jats are a Muhammadan race, who probably belong to the same race as the Jats, who form so large a part of the population of the territories now governed from Lahore and Karachi, and whose origin is so obscure. They are a fine, athletic, dark race, but poor, and usually gain a livelihood as farm servants, barbers, sweepers, musicians, &c.

The Kafars are an interesting race, inhabiting the basin of the Chigar Sarae and contiguous rivers and the ridge of the Hindu-Kush running transversely to the general direction of those streams. No European has ever been in the country, but Raverty, Lumsden, Masson, and others, have collected a good deal of information regarding it. Their appearance is said by Burnes, Wood, Masson, Raverty, and others, to be decidedly European; they are noted, even among the Muhammadans, whom they detest, for the faith with which they keep a compact, and they are immoderately fond of wine. Their language is probably of Sanskrit origin. Their country is especially rich in timber; the slopes and ravines of the Hindu-Kush, as well as many of the lower ranges of hills, being generally covered with primeval forests of pine and other trees. The form of government is a sort of patriarchal republic, and it is one of their boasts that they have never been subdued by any nation.

In addition to the above-named races, there are the Baluchis—a fierce and uncultivated people, to the south of Afghanistan—and a variety of tribes in the hill country north of the Kabul river, who, with the Kafars, appear to be remnants of the aboriginal tribes of the Kabul basin.

Afghanistan is under one prince, who acts as a sort of dictator for life over a military aristocracy of *Sirdars*, who govern in their respective districts. The net revenues of Dost Muhammad Khan were estimated in his later years at about £710,000, including what is known as Afghan Turkistan and Herat. This appeared to be the result of a tax on the produce of the soil, both in kind and money. A house tax of about five rupees is paid by all who are not Pathans, and the Hindus pay the separate poll tax. Customs dues at Kabul and Kandahar are only 2½ per cent., but this is a good deal increased by exactions. In many parts, collections of tribute or taxes are made spasmodically by military force. A regular army was first formed by Dost Muhammad, and in 1858 this contained 16 infantry regiments of nominally 800 men, 3 of cavalry of 300 men, about 80 field pieces and a few heavy guns, besides irregular levies.

The vernacular of a large part of the non-Afghan population is Persian, and this is familiar to all educated Afghans. But the proper language of the Afghans is *Pushtu* or *Pukhtu*, an Aryan or Indo-Persian (not Semitic) dialect. The oldest known work in Pushtu is a *History of the Conquest of Swat*, by Shaikh Mali, chief of the Yusufzaes and leader in the conquest (A.D. 1413-24). Their literature is rich in poetry, Abdurrahman (17th century) being the best known poet.

Over the greater part of the country there are two harvests as in India, but the loftier regions have only one. Wheat is the staple food, but rice is also largely distributed, and is most abundant in Swat. Other products of importance, or raised in large quantities, are garden stuffs or vegetables, especially turnips, ginger and turmeric (grown in the eastern countries), sugar cane, the castor-oil plant, madder, assafœtida, tobacco and fruits. Canal irrigation is employed in the Kabul valley, while in the western provinces the *karez*, a remarkable under-ground aqueduct, in vogue also in Eastern Persia, is much resorted to. The industrial products of Afghanistan are not important. Silk is produced in Kabul, Jalalabad, Kandahar and Herat, particularly the last two named, and the best quality is exported to Bombay. It is said to be capable of much improvement. Felts are extensively manufactured at Kandahar, for carpets, cushions, bedding, horse-clothing, &c., and a variety of woven goods are made from the wool of the sheep, goat and Bactrian camel. Rosaries and charms are manufactured at Kandahar, from a sort of chrysolite, and largely exported, especially to Mecca. The manufacture of *postins* or prepared sheep-skin pelisses has also increased very much in Kandahar, Ghazni and Kabul, principally owing to its adoption as a winter dress by the army of the Punjab. Carpets of an excellent quality are made at Herat, and their prices range from 10 to 1000 rupees. There are practically no roads for wheel carriages in Afghanistan, and nothing is done to facilitate communication, none of the rivers being even bridged. The goods are principally carried on the beasts of burden—chiefly camels, along routes more or less perilous and difficult. The chief routes are:—(1) From Persia by Teheran and Mash-had to Herat. (2) From Bokhara by Merv to Herat. (3) From the same quarter by Karchi, Balkh and Khulm to Kabul. (4) From the Punjab by the Khaibar and Abkhana passes to Kabul. (5) From the same quarter by the Ghawalari or Gomul pass towards Ghazni, and (6) from Sind towards Kandahar by the Bolan pass.

The Afghans as a race are handsome and athletic, often with fair complexions, flowing beards, and highly aquiline features. Both the men and women often have features of Jewish cast. The inhabitants are inured to bloodshed and discord from the first, they are unscrupulous, treacherous, vain, insatiable, and passionate in revenge, which they will satisfy in the most reckless and cruel manner. The spirit of their character and institutions was tersely expressed by an old man to Elphinstone, who had urged the advantage of quiet and security under a strong king—"We are content with discord, we are content with alarms, we are content with blood, but we will never be content with a master."

In a brief article like the present, written mainly from a geographical point of view, a review of the history of Afghanistan would be out of place. We therefore give only the briefest indication of the main facts. The Afghan chroniclers call their people Beni-Israil (Arab for children of Israel) and claim descent from King Saul through a son called Jeremiah and a grandson called Afghana. They further allege that the numerous stock of Afghana were removed by Nebuchadnezzar and found their way to the mountains east of Herat. Alexander's march lay through Seistan and the Helmand valley and he founded a city called Alexandria in the Kabul basin. About 250 B.C. an independent Greek dynasty was established in Baktria, and the Kabul basin formed the starting point of Græco-Baktrian expeditions into India. It is rich in coins of that dynasty. The Pathan dynasties of Delhi form part of Indian history from the 11th to the 16th centuries. The whole of Afghanistan was conquered by Timur, Kabul remaining in the hands of his descendants, and Kandahar being added to it by Sultan Baber in 1522. For the next two centuries Kabul was held by the Mughal Emperors of Delhi, and Herat by Persia, while Kandahar repeatedly changed hands between the two. Nadir Shah the Persian, held the Afghan provinces till his assassination in 1747, after which the different provinces were formed into a single empire under Ahmad Shah Durani, including the Punjab and Kashmir on the south-east and extending to the Oxus on the north. The Afghans first made the acquaintance of Englishmen in 1809, on the occasion of Elphinstone's mission. Burnes visited Kabul on his way to Bokhara in 1832. The restoration of Shah Shuja by the British forces under Sir John Keane in 1838 led to continued insurrections against the new ruler, culminating in the terrible revolt of 1841. The events which followed, the ignominious convention to evacuate, signed by the British, and the fatal retreat from Kabul, are graphically described in Kaye's eloquent pages, as well as the expedition of General Pollock, in which the disasters which had befallen our arms were happily avenged.

Sher Ali Khan succeeded to the throne in 1863, and is now ruler over Afghanistan and Afghan Turkistan, while Badakhshan is tributary to him.*

C. E. D. B.

RICHTHOFEN ON PREJEVALSKY'S JOURNEY IN CENTRAL ASIA.

(Continued from page 227 of our last number).

ONE of the earliest accounts extant regarding the inhabitants of the Lop-Nor district, is found in the report made by Chang-kien (during the Han dynasty) to the king. He said: "By the Salt Lake are situated the walled towns of Liulan and Kuchi, at a distance of 5000 *li* from Chang-ngan, the then capital of China." They were then under the dominion of the Hiungnu, and immediately to the south was the Tibetan country called Kiang. Shortly after the Hiungnu were driven out by the Chinese, who took possession of the land, and with a short interval held it for more than two-hundred years. Kuchi

* We must express our acknowledgments to Colonel H. Yule, C.B., Colonel C. M. Macgregor, C.S.I., and Major H. G. Raverty, whose writings have been of material assistance in the compilation of the above article.

was little known, but the kingdom of Liulan finds frequent mention in the earlier and later annals of the Han dynasty. In the first we find it stated that the number of families in Liulan were estimated at 1500; that they got their supplies from the neighbouring countries; and that their customs were similar to those of their neighbours—the Tibetans. Subsequently the little kingdom was called Shen-shen (a change of name used apparently to denote a larger region than formerly) by the Chinese, while the residence of the Prince was called Yue-ni. The lake received the name Pului-hai and Puchang-hai. After the downfall of the sway of the Han dynasty over the west, we hear but little of the small state by Lop-Nor. In 399, Fa-hien, the Buddhist pilgrim, travelled for seventeen days through the desert of Tun-hwang to Shen-shen, which he described as a mountainous and very uneven country. "The soil," he continues, "is poor and unfruitful. The manners of the inhabitants are as rough as their clothing, but still not unlike those of the Chinese. The people are Buddhists, and there are about 4000 priests among them." This proves that the Chinese had left considerable trace of their influence, and that the number of the population had increased. In 607 Pei-kin was sent by the last prince of the Sui dynasty to Kanchow-fu (at that time the central mart of Central Asian trade) to collect information regarding the different routes. He found that there were three routes in use, two of which were identical as far as Lop, after which they split into the northern and southern routes, while the third went by way of Hami. In 645 Hwen Thsang returned from India. He gave only a brief account of the places seen by him in the latter portion of his journey, and gave the name Nafopo (which Stan. Julien has shown to be of Indian origin) to the ancient Liulan. In 940 the Emperor sent an embassy to Yue-tien or Khotan to enfeoff the king thereof as a vassal, a fact showing how far the Chinese power had declined. The wearisome and perilous journey lasted two years, and after a sojourn there of five years the return journey was commenced. On the way thither the old route was followed as far as Tun-hwang, but in the return journey new names of places are given, which suggest the probability of his having chosen a southern route.

The marvellous rapidity with which the Muhammadan religion spread over Central Asia must have been one of the reasons for the complete dearth of information that set in in the 8th century regarding the routes leading to Lop-Nor; then the route by Hami and the southern foot of the Tian Shan came more and more into use. The gradual drying up of the oasis on the south side of the Tarim basin helped to divert the traffic. In Marco Polo's narrative in 1272 we see that he followed the old route, and that the Lop district was then an oasis which broke the desert transit. The embassy of Shah Rukh in its return journey in 1422 past Lake Lop furnished similar evidence.

Turning to modern times we observe that in some geographical works (but few of which have been translated) regarding certain military expeditions under Kang-hsi (1662-1723), and the great conquests under Kien-lung (1736-1796), the lands about Lake Lop are frequently described. The above-mentioned *Hsi-yue-wonn-kien-lu*, written in 1773, says:—"On the lake are situated two settlements each of 500 houses. The inhabitants are neither agricultural nor pastoral, but live by fishing; they make coats out of swan's down, weave linen out of wild hemp, and bring their fish to market to Korla. They eat neither bread nor meat because it is forbidden them, and speak Turki, yet are not Muhammadans." The latter remark, which is incorrect, arose doubtless from the Muhammadans having repudiated the Lop people on account of their scanty observance of ceremonies.

A noteworthy account is found in a later work, the *Hsi-yue-shui-tanki*, written in 1741, during the Emperor Kien-Lung's reign. After saying that Lake Lop is of very large extent, that 40 years before it had taken an army two months to go round it, it says that the land was divided into two parts, Karakul and Karakodsho. The entire region was under three begs. The people had a different language from other Turks, and attained a good old age. There were 2160 men and women there, and 280 were under a banner and rendered military service. It took not quite a month to go from Tun-hwang to the lake. Seventeen years later there were but 600 men remaining out of 2000.

All these scattered accounts, extending over a period of 2000 years, present a pretty consistent picture. A small nationality or tribe, numbering at first some thousand souls and afterwards diminishing to some hundreds, lived, shut out by wide deserts, in the neighbourhood of a great Salt Lake, the chief feature of the place. Physical circumstances, hitherto not quite clear, appear to have made this locality a central point in different trade routes up to the seventh century, but that after that it gradually fell into disuse. The inhabitants followed the changes of religion made by the other people of the Tarim basin, first to Buddhism and then Islam, while politically they were subject to the chief power—at one time under Khotan, at another under China, and, in the interval between, as a dependency of the kingdom established in the oases to the north. In early times they appear to have kept horses, asses and camels, and later on to have lived by fishing. With regard to the position of Liulan, Shen-Shen and Nafopo, the records of the Han dynasty point to the fact that the small kingdom must have been situated south or south-west of the Khas-omo of the Chinese or Kara-kochun of Prejevalsky, and that the immediate vicinity of the great Salt Lake was uninhabited.

Prejevalsky's account of the people agrees in many respects with the oldest Chinese accounts. He found the people divided into two sections, the Kara-Kul and Karakurtchin living on the banks of the lower Tarim and on the lake respectively. Their mode of living, habits, food, religion and dwelling agrees very closely with what we would have expected and combine to make an interesting picture.

The land of Cherchen. With regard to this country, Prejevalsky remarks that shortly before reaching the Karaburan lake the Tarim receives a tributary coming from the south-west bearing the name Cherchen-daria, Cherchen, the place whence it comes, being about eleven days' journey for a beast of burthen. Prejevalsky estimates this at 300 versts, which appears too high, 220 versts being nearer in Von Richthofen's opinion. From Cherchen it is ten days' journey to Nai, and three from there to Kiria, or thirteen days in

all, while Shaw gave sixteen. Shaw's informant had lived 12 years in Cherchen and was an inhabitant of Khotan. He mentioned maize, wheat, apples, and pears as growing there, but not cotton and rice, whereupon Shaw inferred that it lay at a higher elevation than Kiria.

Cherchen was first known through Marco Polo, who passed through it on the road from Khotan to Lop, from which latter place it is five days distant. In 1867 Johnson published a route from Khotan to Lop, in which the name *Chachan* occurred, which Yule pointed out was evidently identical with the *Charchan* of the Venetian traveller. Johnson stated that the place contained 500 houses, but as it turns out could get no reliable information regarding its distance from Kiria, which according to him was only nine days' journey. Two days distant from the latter place he placed *Nia*, a village of 50 houses, which is evidently the *Nai* of Prejevalsky, though the latter traveller speaks of 900 houses. It is surprising how little the distances given accord with each other. Were it not for the names of the places identification would be well-nigh an impossibility. It is therefore not surprising that Hwen-Thsang, who preferred the Sanskrit names to the native ones, should not agree perfectly with the other travellers. The extreme points of the route *Yu-tien* (Khotan) and *Nafopo* (Liulan) are fixed. The intervals are as follows: 330 *li* to *Pimo*, probably the *Pein* of Marco Polo, then 200 *li* to *Nijang*, which with regard to the distances from Khotan corresponds with Kiria, 400 *li* to the place of the lost kingdom of *Tuholo*, 600 *li* to *Nimo* or *Chemotona*, and lastly, 1000 *li* to *Nafopo*. The distance of 530 *li* from Yu-tien to Nijang, and of 2000 *li* between Nijang and Nafopo corresponds tolerably closely to the distance between Khotan and Kiria, and Kiria and Lake Karaburan, so that Nijang and Kiria may be looked upon as identical. Nimo remains undetermined and may have since altogether disappeared.

The Mountainous Region to the South and South-West.—It is a very difficult matter to ascertain the course and general structure of mountain ranges from natives, particularly where these have only travelled along roads from which the mountains can only be seen at a distance. Prejevalsky had the disadvantage of having inspired mistrust, and of having no qualified interpreter. He learnt that the south-western continuation of the Altyn-tagh ran without a break, and as a wall-like escarpment rising above the desert as far as Kiria and Khotan. If we take this as meaning merely that to anyone journeying along the road, mountains are visible at a greater or less distance, the line of mountains running north-east and south-west as a southern boundary to the Tarim basin becomes a very unlikely feature in the face of the authority of the Chinese maps and the information collected by Shaw. Prejevalsky supplements this by information respecting the mountains south of the lake. He ascertained that the Altyn-tagh was succeeded on the south by a plateau 50 versts wide (*i.e.* one day's journey), the height of which he estimated at 12,000 or 13,000 feet. Then came a second ridge about 20 versts wide, followed by a plain 40 versts wide, consisting of moors dotted with springs and a mighty range called Chamen-tagh. The information given by the native hunters respecting these topographical facts are simple enough to warrant their being considered trustworthy. They represent that the three ridges or chains extend eastward for an unknown distance, while to the west they unite with the *Tugusdaban* which continues as far as Kiria and Khotan. This name appears to be applied to the mountain range itself, and in that sense it has been accepted by Dr. Petermann. But Von Richthofen remarks that this name (properly *Tokus-dawan*) means "the nine passes," and that Shaw had already heard of it. He spells it *Tokos-dewan*, and places it fourteen days' journey east of Cherchen, and says that a road leads thence to Lan-chow-fu. It may be assumed from this that the Tokus-dawan is tolerably well known, and the difference between its position as given by Shaw and Prejevalsky respectively seems to point to its being a frequented route, "the road of the nine passes," and not a particular point. It is not improbably the road leading to Tsaidam, Koko-Nor and Sining-fu on the one side and Khotan on the other.

In addition to the arguments given above, against the theory of a continuous range running south-west and north-east, we have the testimony of Shaw and Johnson that the road from Khotan to Kiria first goes eastward, but afterwards makes a wide sweep and turns northward. Shaw also stated that travellers going from Kiria to Cherchen, in clear weather, could distinguish "black" or snowless mountains on the right, that mountains are not far from Cherchen and Lop, but that from the former place it takes six days to reach the mountains whither hunters, gold seekers, and shepherds go. This may be explained by supposing that waterless spurs extend to the neighbourhood of Cherchen, but that mountains affording water springs and means of support to men and flocks, lie further off. Baron von Richthofen agrees therefore with Shaw, that Cherchen lies in a wide bay formed by the neighbouring mountains.

Viewing Prejevalsky's discoveries as a whole, there is no doubt that they have enlarged our geographical knowledge of Central Asia in an extraordinary degree. The problem of Lop-Nor and its true position is fast nearing solution; that of the reservoir, in which, at least, the greater part of the waters of the Tarim are discharged, is nearly cleared up; the site of the old kingdoms of Liulan and Shen-shen is re-established, explored and described; contrary to received ideas, we have immediately south of the Tarim reservoir, a mountain range, with a precipitous wall-like face rising there to a height of 14,000 feet, and still higher to the south-west, and its probable function as the northern escarpment of the Tibetan plateau defined. Historical events are cleared up by this examination of the physical features of the country, and the isolated inhabitants are made known to us. In addition to this, we are furnished with information regarding the fauna and flora of the country traversed. It is much to be hoped that the expedition of Count Béla Szécsenyi, and the new one on which Colonel Prejevalsky has resolved, will combine to clear up the chief points still awaiting solution in the geography of these regions.

C. E. D. B.

FELIX JONES.

ONE of the greatest ornaments of the old Indian Navy has passed from among us.

Felix Jones served, when quite a boy, on board the 'Palinurus,' under Captain Moresby, when that distinguished seaman executed his survey of the Red Sea, between 1830 and 1834. Though then a very young officer, the skill and taste of Felix Jones as a draughtsman were already appreciated, and the original drawings of the Red Sea Survey were mostly by him. His next service was in the Gulf of Manar and Palk Strait, under Lieut. Powell, when he again acted as draughtsman to the survey. He also made a journey through Ceylon, fixing Adam's Peak and the Horton Plains, and surveying the Caltura river.

In 1841 Felix Jones was with Captain Lynch when that officer commenced the survey of the Euphrates. He was stationed at Baghdad, in command of the 'Nitocris' steamer, and every year he succeeded in completing some interesting and valuable survey, although for the greater part of the time he was almost single handed. In such a region it was impossible to go in any direction without meeting with work well worth the doing, and Felix Jones made the best use of his opportunities. The country, infested by wild tribes of Arabs, was frequently dangerous, and it was necessary to seize upon any chance that offered for exploring and surveying.

In 1844 Captain Felix Jones accompanied Sir Henry Rawlinson on a journey to collect information respecting the boundary between Turkey and Persia. The results were a memoir and a map of a country but little known. In 1846 he made an ascent of the Tigris from Baghdad to Samarrah, on board the 'Nitocris;' and in 1848 he undertook a journey to determine the course of the ancient Néhrwán Canal, and to survey the once fertile region which it irrigated, now a desolate and almost impassable waste. His interesting memoir on the Néhrwán Canal, accompanied by a map, gives the history of the work from the days of its construction in the time of the Sassanian dynasty of Persia, and minutely describes its vast brickwork dams and sluices. In April and September 1850, Captain F. Jones surveyed the old bed of the Tigris, discovered the site of the ancient Opis, and made researches in the vicinity of the Median wall and Physcus of Xenophon. In 1852 he made a trigonometrical survey of the country between the Tigris and the Upper Zab, including the ruins of Nineveh, fixing positions by meridian altitudes of the sun and stars, with chronometric differences for longitude. The results of this work are recorded in the beautiful maps of "Assyrian Vestiges" in four sheets, and in a valuable memoir. During 1853 Captain Felix Jones, assisted by Lieut. Collingwood, completed a map of Baghdad on a large scale, with a memoir on the province full of statistical information; and in 1854 he sent home his maps of Babylonia. They consisted of three sheets, with a detailed memoir, and included the country from Museyb (north of Hillah) down to the north-west end of the sea of Nejf. In 1846 he had compiled a general map of Mesopotamia from Scanderoon on the Mediterranean to El-Básrah, which was based on the surveys by Chesney, Lynch, and himself.

Captain Felix Jones retired from the Mesopotamian Survey to take up the post of Political Resident at Bushire, in the Persian Gulf, in 1855. He possessed all the knowledge and tact which were necessary for an officer in his position. For the work of the Mesopotamian Survey several acquirements were essential in addition to those of a surveyor, such as an acquaintance with the language and ancient history of the country, tact and judgment in dealing with Arab tribes, and capacity for enduring fatigue and privation. All these were possessed by Felix Jones in an eminent degree.

In 1857, while he was Political Resident at Baghdad, the Persian war broke out. This he had foreseen and provided for by furnishing to the Government of India an elaborate plan for invasion, containing itineraries through Persia, and guides for the Commissariat Departments of the army and navy. This report obtained for him great commendation under Earl Canning's own hand. Assisted by Colonel Malcolm Green, he made a survey of the Shattu-'l-'Arab, including the Karûn, which enabled Sir James Outram to attack Muhámmerah.

It will scarcely be believed that for all these great services, extending over a period of thirty years, Captain Felix Jones never received any honorary recognition from his Sovereign.

His geographical papers will be found in the *R.G.S. Journal* (xviii. p. 1), and in the volume of *Bombay Selections* (New Series. No. xliii.), as well as in the *Transactions of the Bombay Geographical Society* (xvii. p. 119). He also published *Narrative of a Journey through parts of Persia and Kurdistan in company with Major Rawlinson.* Bombay, 1849 (8vo).

Captain Felix Jones returned to England with his family in 1858, and of late years resided at a house called Fernside, in Upper Norwood. In 1864 he became a Fellow of the Royal Geographical Society. He served on its Council, and was a valued contributor to this Magazine. He was also a member of the Geographical Club.

The last useful work upon which Captain Felix Jones was engaged, was the compilation and construction of a new map of Western Asia, including the valleys of the Euphrates and Tigris, from the materials accumulated by the surveyors of the Indian Navy and other observers. His services were secured for this purpose by the Secretary of State for India in 1872, and, through the courtesy of the Crystal Palace Company, Captain Felix Jones was provided with excellent quarters wherein to work at his map. It was completed in 1875, and consists of four double elephant sheets. The first (N.W.) includes the range of the Taurus and the water-partings of the Euphrates and Tigris. The second (N.E.) extends from Erzeroum to the frontiers of Russia, Persia, and Turkey around Mount Ararat. The third (S.W.) embraces Syria south of Lebanon to the Suez Canal and Mount Sinai; and the fourth (S.E.) takes in Mesopotamia to the Persian Gulf. This map is a beautiful specimen of draughtsmanship; but it still remains in manuscript at the India Office.

Captain Felix Jones died at his house at Fernside, on September the 3rd, 1878.

Reviews.

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ILLUSTRATION OF THE ARCTIC EXPEDITION.—1875-76.*

It has often been remarked that the Arctic Regions have a great fascination for those who have once crossed the circle and entered the frigid zone, and that officers who have served in a former expedition are generally eager to sail northwards again as soon as an opportunity offers. One reason for this longing is the beauty and grandeur of the scenery, which never fails to make a deep impression upon every observant mind. The gorgeous skies and stupendous ice mountains when once seen can never be forgotten, and their memory ever afterwards is a source of pleasure and delight.

The pictures of Mr. Bradford and of Rasmussen convey some idea of the beauties of Arctic scenery, and gifted artists have not been wanting among the officers of former expeditions. After the return of Sir James Ross in 1849 the water-colour sketches of Lieut. Browne were published by Messrs. Ackermann, and a very striking Arctic Panorama was exhibited in Leicester-square. The expedition of Captain Austin (1850-51) was specially rich in artists well qualified to give permanence to their impressions of the scenery. Lieut. Browne was among them and painted the scenes for the Royal Arctic Theatre, as well as McDougall the artist of the *Illustrated Arctic News*, which was published in *facsimile* by Messrs. Ackermann, and Mr. W. W. May, who has since won fame as an eminent water-colour painter, and whose Arctic pictures have established his reputation. In the 'Investigator,' with Sir Robert McClure, several beautiful sketches were drawn by Lieut. Cresswell and afterwards published, while, in Sir H. Kellets' ship, McDougall was again serving (1852-54), and illustrated his own valuable work *The Voyage of H.M.S. 'Resolute.'*

The Arctic Expedition of 1875-76, so well supplied with admirably-qualified men for every other branch of work, did not fail in the important business of illustrating the scenery of the newly-discovered region. Two series of photographs were taken by Mr. White on board the 'Alert,' and by Mr. Mitchell in the 'Discovery,' while Dr. Moss completed an excellent set of water-colour sketches. The skill of Dr. Moss as an artist is of a high order, and his countrymen are indebted to him for enabling them to form some idea of the grandeur and beauty of the scenery in the new polar region discovered by the late expedition.

Dr. Moss's sketches have now been published in the form of chromo-lithographic facsimiles. He justly claims for them the merit of being perfectly faithful efforts to represent the face of nature in a part of the world that very few can ever see for themselves. The woodcuts are excellent, and in their way quite as good as the chromo-lithographs, but the latter alone cannot convey any notion of the scenery. Among the best are No. IX. "The Dawn of 1876," No. X. "From amongst the barrier bergs," and No. XI. "From amongst the floe bergs looking south." These will give a correct idea of the exquisite loveliness of the polar skies. Of a more sombre character, but still admirable in their way, are No. XIV. "The most northern grave," and No. V. "Winter Quarters outside." But it is perhaps misleading to mention special sketches when all are so good. Dr. Moss's work undoubtedly forms a very important part of the record of the expedition, and the handsome way in which this splendid volume has been got up makes it a worthy as well as an essential portion of the history of the most brilliantly successful and important enterprise that has ever reaped laurels in the far and unknown region of the Pole.

* *The Shores of the Polar Sea: a Narrative of the Arctic Expedition of* 1875-76. By Dr. Edward Moss, H.M.S. Alert: illustrated by 16 chromo-lithographs and numerous engravings from drawings made on the spot by the Author. (Marcus Ward and Co., Belfast and London 1868), folio pp. 83.

TROPICAL NATURE.*

Mr. Wallace's reputation is an ample guarantee for the fidelity of the general picture in the present volume of the essential characteristics of the tropical, as distinguished from the temperate, zones. This subject, with which his twelve years' residence in the equatorial zone has well qualified him to deal, forms the backbone of the work, which is supplemented by a few lectures on kindred topics, delivered originally before the Royal Geographical Society, and other bodies. Such are those on "By-paths in the Domains of Biology" and "The Distribution of Animals as indicating Geographical changes." The author details the various causes operating specially on the equatorial characteristics (the most prominent among these being the *uniformity* of the climate as opposed to the variableness of the temperate zones), and then proceeds to deal with these characteristics themselves. Beginning with equatorial vegetation, he observes that, with but few and unimportant exceptions, a great forest band, from 1000 to 1500 miles in width, girdles the earth at the equator, clothing hill, plain, and mountain, often to a height of eight or ten thousand feet, with an evergreen mantle. Beyond the forests, both to the north and south, are bands of woody, open and arid, or even country, girdling the earth, except where broken by sea, in successive zones. Of the last, we have examples in the dry plains of Mexico, the Sahara, the Arabian deserts, those of Baluchistan and Western India, and to the north and east those of Western Turkistan and the Gobi. Meteorological causes operating on these belts of arid desert cause a considerable precipitation of moisture on the equatorial zone, and this favours the growth of lofty trees rising to a great height without a branch. Many of these have thin slabs radiating from the trunk like the buttresses of a Gothic cathedral. Other features of the tropical forest are the flowering trunks, the woody creepers, and climbing plants, these last of such mysterious growth that their origin and development have always been a complete puzzle. Probably the palm and the bamboo are the most valuable products of equatorial regions. The Arabs boast, and with justice, that the palm supplies them with food, drink, clothing, and building materials. Besides this, Mr. Wallace cites sago, wine,

* *Tropical Nature and Other Essays.* By Alfred R. Wallace. London (Macmillan & Co.), 1878.

sugar, bread, oil, salt, fruit, vegetables, hats, ropes, bows, blow-pipes and even fish-hooks as products of the palm-tree. But the bamboo would seem fairly to eclipse the palm in usefulness. From it are made spears (both shafts and blades), ladders, masts, bridges and entire houses, comprising not only the walls, roofs, joists and flooring, but also the chairs, sofas, bedsteads, pipes, musical instruments, cooking-pots, and even the very vegetables to put in them!

It is a common but erroneous idea that the luxuriant vegetation of the tropics is characterised by a grand display of floral beauty, but Mr. Wallace points out that this is a mistake, and that brilliancy and conspicuousness in flowers must be sought for amid alpine regions and near the limits of perpetual snow. Another peculiarity of tropical vegetation is the extraordinary variety of trees in a forest, so that a traveller may often look for a length of time for a second tree of similar kind to one he may have met.

The *fauna* is noticed by Mr. Wallace in the same manner. He observes that the first impression is one of the scantiness of animal life in equatorial forests, but this proceeds mainly from the excessive shyness and retiring habits of the animals themselves. The butterflies are without doubt the most numerous, attractive, and characteristic of the equatorial fauna, and round the town of Para more than 700 species have been found, contrasting both in size, magnificence, and number with the sixty-four species found in Britain.

Other characteristic animals are ants, parrots (most numerous in the Australian region, from Celebes eastward), monkeys, lizards, and frogs. These and other animal forms manifest endless eccentricities of shape and richness of colour, two characteristics probably due to the uniformity and permanence of the climatic conditions found in the equatorial region during long series of ages. A special chapter is devoted to that important family peculiar to tropical America, namely the humming birds, which number no less than four hundred different kinds, varying in size from a swallow to a little larger than a humble-bee.

The remainder of the present volume is made up of the lectures above referred to, with an article, originally published in *Macmillan's Magazine*, on the colours of plants and animals. It follows appropriately on the preceding chapters. Mr. Wallace's little work is certain to be widely read, as displaying the matured observations of a man of acknowledged scientific culture on topics of general interest in the domain of natural science.

CYPRUS: ITS RESOURCES AND CAPABILITIES. By *E. G. Ravenstein, F.R.G.S.* With Maps and Plans. London (Philip & Son) 1878.

THIS is certainly the most carefully compiled, as well as the most comprehensive, for its size, of the various works which the British annexation of this island has called into being. Mr. Ravenstein has been careful to go to original works of acknowledged authority, and not as he puts it "to Encyclopædias or Gazetteers" for his information, which he presents to us judiciously condensed within a compass of 55 pages. The most useful part of his work will probably prove to be the hints to travellers, though there is not a superfluous paragraph for any one wishing to gain a preliminary knowledge of the island. We should have liked to have had rather more information about the antiquities, considering the exceptional interest and beauty of those brought to light. The maps, as might be expected from Mr. Ravenstein's geographical reputation, are excellent, and the best we have seen. As the season for travelling in Cyprus (February to May) will soon be approaching, travellers will do well to purchase this handy little guide.

Log Book.

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A Stout Old Arctic Ship.—When we were working through the ice floes of Melville Bay, in the summer of 1850, we were in company with a fine old ship and a fine old skipper. The ship was the 'True Love' of Hull. The skipper was Captain Parker, a gallant and experienced ice navigator who commanded her for many years. The 'True Love' was then sixty years old, and year after year she had sailed from Hull, battled with the ice in Melville Bay, and returned with a cargo of whale oil. When Hull ceased to send out whalers, and steamers took the place of sailing vessels, the old 'True Love' no longer sought the icy seas. Still she continued to make voyages in other directions. We have just heard that she was broken up in this year of grace 1878. A strong and well-built ship was the 'True Love' of Hull, and she must have counted upwards of ninety years of serviceable work before her days were all numbered.

Captain Cameron's Expedition to the East.—On the 18th of August, Capt. Lovett Cameron, R.N., C.B., left Portsmouth in H.M.S. 'Orontes' for Cyprus, a passage thither having been granted him by Government. After a short stay in our newly-acquired island, the gallant explorer proceeds to Latakieh, Aleppo, Urfah, Mardin, Mosul, Baghdad, Bussorah, and through South Persia and Baluchistan to Karachi, his object being to ascertain the practicability of the Euphrates valley for railway communication with the north-west of India. Capt. Cameron's expedition is not a Government enterprise, and is undertaken on his own responsibility. He hopes to be able to survey the country through which he passes, and has with him the necessary appliances for taking photographs and making a botanical collection. We feel sure that the examination of this important route could not be in better hands.

Geographical Results of the late Jowaki Expedition.—The late Expedition against the Jowakis on the North-west frontier of India deserves a passing mention from a geographical point of view. The country invaded belongs to the Adam Kheyl, a section of the great Afridi tribe, and lies to the east of a line drawn from Peshawar to Kohat. Though jutting into our territory like a wedge, and almost enclosed by it, the district had hitherto been unvisited by Englishmen, its reported inaccessibility being naturally exaggerated, and perhaps honestly believed in by its possessors. The expedition was in every way successful; the casualties, owing to the long range of our rifles, and the advance of the troops being always covered by artillery, were very few, and the impossibility of a defence was clearly demonstrated to the tribes. Lastly, a difficult piece of country, some 16 by

13 miles in extent, was traversed by the force in every direction, and this, as well as the Kohat pass itself and neighbouring heights, has been accurately surveyed, making a timely and important accession to our knowledge of the frontier. A description of the country, with a map and a full account of the expedition and its bearing on various problems of hill warfare, from the pen of Captain John Mowbray Trotter, D.A.Q.M.G., attached to the force, appears in the *Proceedings of the United Service Institution of India* for July.

Vegetation of Asia Minor.—Herr A. von Schweigerfeld contributes to the Vienna Geographical Society's monthly *Mittheilungen*, a carefully-compiled map of Asia Minor, showing the variations of height both on the map and by sectional views. He also indicates the character of the vegetation of the country by dividing it into three zones—the Black Sea, the Mediterranean and the Anatolian. The southern coast region of the Black Sea is remarkable for the profusion of its fruit trees, while to the west the same region is characterised by a prevalence of forest vegetation. In further Asia Minor the dense forests which in former times covered the hilly land have now disappeared for some distance from the coast. The Black Sea region, as marked out by the author, extends from the Dardanelles to Trebizond; the Mediterranean region from the entrance to the Bosphorus round to the coast of Syria; while the interior, east of the 29th meridian of longitude, a tract with a comparatively deficient rainfall, is called the Anatolian steppe region. Each of these zones is characterised by a certain peculiarity in its vegetation, which is detailed with clearness by the author in some explanatory notes. The map shows the gradations of height throughout Asia Minor according to Dr. Petermann and Dr. Kiepert's maps.

Russian Map of Central Asia.—The most recent edition of the Map of the Turkestan Military Circuit, prepared in the Turkestan Topographical Department, 40 versts to an English inch, differs but slightly from the one noticed in our number for September, 1877. We then drew attention to the considerable extension of the Russian frontier line to a point south of the Kara-Kul lake on the Pamir steppe, and about 150 miles removed in a direct line from the northernmost point of the Maharajah of Kashmir's dominions. This new frontier line is much more distinct on the present map, owing to the colouring, and shows clearly that the "no man's ground" between the Asiatic possessions of England and Russia is considerably less than is assumed in the recent telegram from the Calcutta correspondent of the *Times*. The map we are speaking of is based on Colonel Walker's excellent map of Turkestan (the 1875 edition), but there is a great deal of new material. Eastward, Prejevalsky's discoveries are shown (not over neatly). Southward, the details are all taken from Walker's map, but north of the Oxus there is a great deal of fresh information chiefly derived from the results of the military expedition to the Alai. The course of the Murghabi, or Bartang river, is considerably altered, as are also those of the Muk-su and Kizyl-su, while in Karateghin, Hissar, and Ferghana the topography is far more detailed than on the English map.

Scientific Expedition to Socotra.—The British Association have sanctioned a scheme for the despatch of an expedition to study the natural history of the island of Socotra. The most important of the vegetable productions of the island appear to be the Sokotrine aloes (the finest in the world), the dragon's blood gum and date palm. The terrestrial fauna appears scanty, but the sea swarms with fish, while amber, ambergris and pearls have been exported, and fisheries of the latter are still worked.

Dr. Schweinfurth has written to the *Esploratore* on the subject of travelling in the Sudan, accusing the Government officials in that province of obstructing travellers by every possible means, and stating that the slave trade still goes on, contrary to the repeated asseverations of the Government, but that instead of being conducted along the principal routes, the slaves are driven along byeways and thus exposed to much greater suffering.

Correspondence.

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CIRCULATION OF THE OCEAN.

To the Editor of the "Geographical Magazine."

Sir,—This subject has been touched on lately, and no law is as yet laid down for the action. Nothing cosmical can be done without law, but we find in reading the Address of Sir C. Wyville Thomson, F.R.S., in the Geographical Section E, British Association, Dublin, that he has alluded to certain phenomena on which a few observations may not only be interesting in the abstract, but may eventually lead to a more perfect comprehension of this vast problem. Sir C. W. Thomson has come to the conclusion that the great water movements are from a "*cold source*," and certain facts "indicate the southern position of that source."

This is called a very unexpected phenomenon, and its explanation is thus attempted:—

"For some cause or other, as yet not fully understood, evaporation is greatly in excess of precipitation over the northern portion of the land hemisphere, while over the the water hemisphere, and particularly over its southern portion, the reverse is the case: thus one part of the general circulation of the ocean is carried on through the atmosphere, the water being raised in vapour in the northern hemisphere, hurried by wind currents to the zone of low barometric pressure in the south, where it is precipitated in the form of snow or rain, and welling thence northwards in the deepest channels on account of the high specific gravity dependant on its low temperature, it supplies the place of the water which has been removed." This grand reciprocal movement of air and water falls in with the give-and-take system of the elements so long insisted on by me, and so visible to any one who watches their actions and reads their records from observing pens. There is, however, something wanting in these few lines quoted from the *Geographical Magazine* for September 1878. There is no actual proof that the evaporation exceeds the precipitation in the north, or that the precipitation of the south is supplied by the evaporation, of the north. Nature does not demand these actions

and yet there is a greater amount of precipitation into the waters of the southern hemisphere than into the waters of the north. We have no proof that the evaporation is greater in one hemisphere than in the other, unless a larger water surface in the south gives an easier supply than the smaller water surface of the north. Under all circumstances the waters maintain their general level, and we have seen by the researches of the 'Challenger' there are surface and under currents all round the world. It has been a received opinion for some time that tropical warm currents run on the ocean surface to the frigid zones, and return in a cold and a heavier condition as sub-currents to the tropics. The supply is therefore kept even: no current can run into a full space, and full places must empty themselves, in consequence of a never-ceasing pressure into the for-ever-moving space. There is then a constant demand and a constant supply, both regulated by heat and cold, or, in other words, by sunshine and its absence.

As the largest rivers on dry land tell us of the most copious supplies, so the great ocean currents tell us not only of the most plentiful supplies, but point to places where they go to as having a constant demand. As long as the ocean keeps its general level the demand and supply must be equal, and as the water gets warm and light in the tropics, cold and heavy in the frigid zones, the sub-current must flow from them to equalise the warm light supplies taken from the tropics to the poles. As far as ocean currents go there seems no necessity for northern water to flow beyond the equator, or for southern water to run into the north in their relative cold conditions. When the unavoidable change takes place within the tropics, when the once cold streams of the bottom rise in their lightness and their warmth to the surface, then they point to the north in the great Gulf stream as the region where they find the greatest demand.

Under the process suggested by Sir C. Wyville Thomson, we are led to imagine that this demand in the north is caused by the removal from thence of a portion of its evaporated moisture by the winds to the southern hemisphere. Under the natural condition of these regions such a labour is uncalled for, and as all the works of nature are done by law, we must look to the elemental actions to comprehend why the demand for more water is for ever prevalent in the Arctic ocean. The subject divides itself into two heads—currents and evaporation. Evaporation falls into two parts, the direct and indirect. Taking the latter first, it embraces all that evaporated moisture which falls upon the surface of dry land. This again is divided into that which sinks into the soil, and that which runs off the surface into rivers. This latter returns to the ocean or the lake without much loss of time, the former has much duty to do before it reaches that destination; some of it runs into springs to supply the perennial rivers, some percolates the subterranean world, and is found at varied depths in wells, and other excavations by man. A vast quantity is absorbed by vegetation and by animal. The quantity of fresh water that has been evaporated, precipitated, and thus used, is literally beyond computation. The greatest portion of dry land is in the northern hemisphere; nearly all of this is covered with vegetation and water-using organisms, all of this and all the subterranean water is withdrawn from the ocean for indefinite periods. The volumes of water returned by our great rivers have been calculated, but as the Psalmist says—"Unto the place from whence the rivers came thither they return again, yet the sea is not full,"—so as they empty themselves in all directions, and many of them far away from the scene of demand, they and the other causes absorb unknown quantities of precipitated rain, some of which was evaporated from the ocean. Thus it happens that unknown quantities of water are perpetually withdrawn from the ocean by evaporation, and that only a part of this is precipitated direct as rain, or indirect from the dry land back to the great waters. As these uses for water are perpetual, as most of it comes from the sea, there must be in it a perpetual demand, especially in the northern hemisphere; while in the south, where the dry land has a smaller area, the greater proportion of its evaporated moisture falls directly on the ocean surface.

The southern hemisphere thus gets its own returned again, so that its volume is not materially decreased, and as the warm surface currents for ever flow towards it, it has of necessity a surplus of cold water, which, as Sir Wyville tells us, perpetually "wells northwards." The ocean currents are known and charted on the surface, but the sub-currents are still undefined; till they are we cannot say that currents from the South Pole run to the North Pole, or that the evaporated moisture of the north is used to supply the demands in the south. There are laws for water and air currents; those laws can not be broken. The ostensible law-giver is the sun; the centre of his rule on earth is within the tropics. From these regions he extracts the gases; there his laboratory expands the air and the water, and from thence each element moves calmly or forcibly as the law demands. This law may move air and water from pole to pole, but in the journey both must pass through the gates of warmth and love—gates which usher in both elements to do their cosmical duties, which could not be done by a cold transit from one extremity of the earth to the other.

We have no intention of disputing the facts as laid down by Sir Wyville Thomson, but there are certain laws which materially interfere with the system laid down in the above quotation. The same end is reached by a different route; it is possible that Sir Wyville may include it in what he says is not yet "fully understood."

H. P. MALET.

Proceedings of Geographical Societies.

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BRITISH ASSOCIATION.

GEOGRAPHICAL SECTION (E.)

(Continued from page 246 of our last number.)

"But little progress has been made during the last quarter of a century in the actual investigation of the conditions of that vast region which lies within the parallel of 70° S. Some additional knowledge has been acquired, and the light which recent inquiries have thrown upon the general plan of ocean circulation and

the physical properties of ice, have given a new direction to what must partake for some time to come of the nature of speculation.

"From information derived from all sources up to the present time, it may be gathered that the unpenetrated area of about 4,700,000 square miles surrounding the South Pole is by no means certainly a continuous "Antarctic Continent," but that it consists much more probably partly of comparatively low continental land, and partly of a congeries of continental (not oceanic) islands, bridged between and combined, and covered to the depth of about 1,400 feet, by a continuous ice-cap, with here and there somewhat elevated coutinental chains, such as the groups of lands between 55° and 95° W., including Peter the Great Island and Alexandra Land, discovered by Billingshausen in 1821, Graham Land and Adelaide Island, discovered by Biscol in 1832, and Louis Philippe Land by D'Urville in 1838, and at least one majestic modern volcanic range discovered by Ross in 1841 and 1842, stretching from Balleny Island to a latitude of 78° S., and rising to a height of 15,000 feet. It seems, so far as is at present known, that the whole of the Antarctic land, low and high, as well as the ice-cap of which a portion of the continuous continent may consist, is bordered to some distance by a fringe of ice, which is bounded to seaward by a perpendicular ice-cliff, averaging 230 feet in height above the sea-level. Outside the cliff a floe, which attains near the barrier a thickness of about 20 feet, and in some places by piling a considerably greater thickness, extends northwards in winter to a distance varying according to its position with reference to the southward trending branches of the equatorial current; and this floe is replaced in summer by a heavy drifting pack with scattered icebergs. Navigating the Antarctic Sea in the southern summer, the only season when such navigation is possible, it has been the opinion of almost all explorers, that after forcing a passage through an outer belt of heavy pack and icebergs, moving as a rule to the north-westward, and thus fanning out from the ice-cliff in obedience to the prevailing south-easterly winds, a band of comparatively clear water is to be found within.

"Several considerations appear to me to be in favour of the view that the area around the South Pole is broken up and not continuous land. For example, if we look at a general ice-chart we find that the sea is comparatively free from icebergs, and that the deepest notches occur in the 'Antarctic Continent' at three points, each a little to the eastward of south of one of the great land masses. Opposite each of these notches a branch of the equatorial current is deflected southwards by the land, and is almost merged in the great drift-current which sweeps round the world in the Southern Sea before the westerly anti-trades. But while the greater portion of the Brazilian current, the East Australian current, and the southern part of the Aghulas current are thus merged, they are not entirely lost; for at these points of junction with the drift-current of the westerlies, the isobathytherms are slightly deflected to the southwards, and it is opposite these points of junction that we have comparatively open sea and penetrable notches in the southern pack. But we have not only the presumed effect of this transfer of warmer water to the southwards; we were able to detect its presence in the 'Challenger' by the thermometer. Referring to the result of a serial temperature sounding on February 14, 1874, with a surface temperature of 29° F. at a depth of from 300 to 400 fathoms, there is a band of water at a temperature of more than half a degree above the freezing point. That this comparatively warm water is coming from the north there is ample proof. We traced its continuity with a band at the same depth gradually increasing in warmth to the northward, and it is evident that its heat can be derived from no other source, and that it must be continually receiving new supplies, for it is overlaid by a band of cold water, tending to mix with it by convection.

"It is, of course, possible that these warm currents may by coincidence be directed towards those notches already existing in a continental mass of land; but such a coincidence would be remarkable, and there is certainly a suggestion of the alternative that the 'continent' may consist to so great an extent of ice as to be liable to have its outline affected by warm currents.

"In high southern latitudes it seems that all the icebergs are originally tabular, the surface perfectly level and parallel with the surface of the sea, a cliff about 230 feet high bounding the berg. The top is covered with a layer of the whitest snow; now and then a small flock of petrels take up their quarters upon it, and trample and soil some few square yards, but after their departure one of the frequent snow showers restores it in a few minutes to its virgin whiteness. The upper part of the cliff is pale blue, which gradually deepens towards the base. When looked at closely the face of the cliff is seen to be traversed by a delicate ruling of faint blue lines, the lines being more distant from one another above and becoming gradually closer. The distance between the well-marked lines near the top of a berg may be of a foot or even more, while near the surface of the water it is not more than two or three inches, and the space between the blue lines have lost their dead whiteness and have become hyaline or bluish. The blue lines are very unequal in their strength and in their depth of colouring; sometimes a group of very dark lines gives a marked character to a part of a berg. Between the stronger blue lines near the top of the cliff a system of closer lines may be observed, marking the division of the ice by still finer planes of lamination; but in the narrower spaces near the water-line they are blended and lost. The blue lines are the sections of sheets of clear ice; the white intervening bands are the sections of layers of ice where the particles are not in such close contact—ice probably containing some air.

"The stratification in all these icebergs is, I believe, originally horizontal and conformable, or very nearly so. In many, while melting and beating about in the sea, the strata becomes inclined at various angles, or vertical, or even reversed; in many they are traversed by faults, or twisted, or contorted, or displaced; but I believe that all deviations from a horizontal arrangement are due to changes taking place in the icebergs themselves.

"I think there can be no doubt, from their shape and form, and their remarkable uniformity of character, that these great table-topped icebergs are prismatic blocks riven from the edge of the great Antarctic ice-sheet. I conclude, therefore, that the upper part of the iceberg, including by far the greater part of its bulk, and culminating in the portion exposed above the surface of the sea, was formed by the piling up of successive layers of snow during the period, amounting perhaps to centuries,

during which the ice-cap was slowly forcing its way over the low land, and out to sea over a long extent of gentle slope, until it reached a depth considerably beyond 200 fathoms, when the lower specific weight of the ice caused an upward strain which at length overcame the cohesion of the mass, and portions were rent off and floated away. The icebergs when they are first dispersed float in from 200 to 250 fathoms; when, therefore, they have been drifted to latitudes of 65° or 64° south, the bottom of the berg, the surface which forced itself glacier-like over the land, just reaches the layer at which the temperature of the water distinctly rises; and is rapidly melted, and the pebbles and land *débris* with which it is more or less charged are precipitated. That this precipitation takes place all over the area where the icebergs are breaking up, constantly and to a considerable extent, is evident from the fact that the matter brought up by the sounding instrument and the dredge is almost entirely composed of such deposits from ice; for diatoms, foraminifera, and radiolarians are present on the surface in large numbers, and unless the deposit from the ice were abundant it would soon be covered and masked by the skeletons of surface organisms.

"The curious question now arises, what is the cause of the uniform height of the southern icebergs—that is to say, what is the cause of the restriction of the thickness of the free edge of the ice-cap to 1,400 fathoms? I have mentioned the gradual diminution in thickness of the strata of ice in a berg from above downwards. The regularity of this diminution leaves it almost without a doubt that the layers observed are in the same category, and that therefore the diminution is due to subsequent pressure or other action upon a series of beds, which were at the time of their deposition nearly equally thick. About 60 or 80 feet from the top of an iceberg, the strata of ice a foot or so in thickness, although of a white colour and thus indicating that they contain a considerable quantity of air, are very hard, and the specific weight of the ice is not much lower than that of layers three inches thick nearer the water-line of the berg. The upper layers have been manifestly produced by falls of snow after the berg has been detached.

"Now it seems to me that the reduction in thickness cannot be due to compression alone, but that a portion of the substance of the lower layers must have been removed. It is not easy to see why the temperature of the earth's crust, under a widely extended and practically permanent ice-sheet of great thickness, should ever fall below the freezing point; and it is a matter of observation that at all seasons of the year vast rivers of muddy water flow into the frozen sea from beneath the great glaciers which are the issues of the ice-sheet of Greenland. Ice is a very bad conductor, so that the cold of winter cannot penetrate to any great depth into the mass. The normal temperature of the surface of the earth's crust, at any point where it is uninfluenced by cyclical changes, is at all events above the freezing point, so that the temperature of the floor of the ice-sheet would certainly have no tendency to fall below that of the stream passing over it. The pressure upon the deeper beds of the ice must be enormous at the bottom of an ice-sheet 1,400 feet in thickness—not much less than a quarter of a ton on the square inch. It seems, therefore, probable that under the pressure to which the body of ice is subjected a constant system of melting and regulation is taking place, the water passing down by gravitation from layer to layer until it reaches the floor of the ice-sheet, and finally working out channels for itself between the ice and the land, whether the latter be subærial or submerged.

"I should think it probable that this process, or some modification of it may be the provision by which the indefinite accumulation of ice over the Antarctic continent is prevented and a certain uniformity in the thickness of the ice-sheet maintained—that, in fact, ice at the temperature at which it is in contact with the surface of the earth's crust within the Antarctic regions cannot support a column of itself more than 1400 feet high without melting. It is suggested to me by Prof. Tait that the thickness of the ice-sheet very probably depends upon its area, as the amount of melting through squeezing and the earth's internal heat, will depend upon the facility of the escape of the water. The problem is, however, an exceedingly complex one, and we have perhaps scarcely sufficient data for working it out."

The PRESIDENT concluded his address with a brief reference to the fauna of the deep sea.

Captain VERNEY proposed a vote of thanks to the President, which was seconded by Sir RAWSON RAWSON, and passed with great acclamation.

The Rev. F. W. HOLLAND, M.A., F.R.G.S., then read a paper

"*On a Journey on Foot through Arabia Petræa.*"

Mr. HOLLAND said the objects of his expedition were (1) to examine the sandstone district in the peninsula of Sinai, lying between the ancient Egyptian mining stations of Wady Mugharah and Sera-bit-el Kadim, with the view of the possible discovery of further Egyptian ruins or inscriptions; (2) to trace out the various routes that the children of Israel might have taken on their journey northwards from Mount Sinai to Kadesh Barnea, so as to institute a just comparison between the facilities or difficulties which attend them; (3) to explore Jebel Mukrah and Ain Kadeis, in the hope of throwing some additional light upon the disputed questions of the site of Kadesh Barnea and the boundary of the ancient kingdom of Edom; and (4) to follow the road from Wady el Arish, by the ancient Lake Sirbonis, to Kantara. With these objects in view Mr. Holland left Suez on the 31st of March, attended by only three Arabs of the Jowrah tribe. After describing his route, he proceeded to give the results of his journey. He found extensive turquoise mines, worked by the Arabs, between Wady Mughara and Wady Nusb, but no further Egyptian mines or inscriptions. He traced and mapped out the course of the Wady Sahore, an important valley previously unexplored, and found that it formed the upper portion of Wady Skellah, which takes its name—"The Valley of Cataracts"—from the water which flows down it. He does not agree with the identification of Ain el Huthera with Nazareth, nor does he believe it possible for the Israelites to have journeyed that way. Following up the course of the Wady Murah, he explored the passes of Jebel Thallah and the plateau of Teranile, afterwards

descending near Zelleger, Wadies Edria and Boigan, and the pass of El Mirad. He finally came to the conclusion that the only available route for the children of Israel to have taken was that by Wadies Zellyer and El Atiyeh, which afforded the most direct, the best watered, and by far the most easy course from Jebel Musa northwards. The position of Jebel Mukrah was found to be far from correct as shown on existing maps, and after carefully exploring the Wady Kadeis, Mr. Holland came to the conclusion that its position militates strongly against its identification with Kadesh Barnea. Jebel Mukrah shows traces of ancient habitation and cultivation, and extends eastwards only about as far as long. 35, where it ends abruptly in a steep cliff, and is separated from Jebel Jerafeh by the head of Wadies Garaigeh and Jerafeh. Kadesh Barnea Mr. Holland would place at the south-east point of Jebel Mukrah, but he was unable to descend into the plain. His intention of following down Wady el Arish to the coast from Wady Noweilah was given up on account of the bed of the wady proving a very bad road for travelling, and also because he learnt from the Arabs of a more direct road westwards to Ismailia, and which appeared a very important one for exploration. He had not found it marked on any map, but it was described to him as easy, direct, and well watered, which he found to be correct. The discovery of this road Mr. Holland regards as one of the greatest importance, and, as far as he is aware, was not previously known. He arrived at Ismailia on the 23rd of May.

In the discussion which followed the reading of the paper, Canon TRISTRAM and Major WILSON spoke in high terms of the importance to geography of Mr. Holland's journey.

Lieut. H. H. KITCHENER, R.E., F.R.G.S., next read a paper

"On the Survey of Galilee."

He described at length the manner in which the survey had been carried out, and gave some very interesting descriptions of the manners and customs of the peoples encountered, and the chief places of interest throughout the country. Having informed the meeting what had been done, he briefly referred to the proposed new work. If funds were available an expedition would start to explore the sites of the most sacred scenes of the New Testament history—the northern shores of the Sea of Galilee, where undoubtedly Capernaum, our Lord's own city, and Bethsaida, still exist. In addition to this, the expedition would make a thorough survey of the unknown country forming the eastern shores of that sea, on the same scale and with the same accuracy as the present survey. One more task they had set themselves, which was to rescue from the hands of that ruthless destroyer, the uneducated Arab, one of the most interesting ruins in Palestine—the synagogue of Capernaum, which was rapidly disappearing, owing to the stones being burnt for lime.

Major WILSON and the Rev. Canon TRISTRAM bore testimony to the importance of the survey, and the PRESIDENT, in thanking Lieut. Kitchener for his interesting paper, trusted that it would be continued under the excellent guidance of those gentlemen who had had it in charge. He considered it their absolute duty to lose no time in preserving those landmarks that still remained, and to this effect representations should at once be made to the Government.

Meeting of August 16th 1878.

Sir C. W. THOMPSON in the chair. The business of the second day commenced with a paper by J. S. PHENE LL.D., F.S.A.,

"On Notes on Some Geographical Variations on the Coast of France."

The author drew attention to the new and most important field of research adopted by the geographers of France, in investigating matters of great interest in the localities of their own country, without the necessity of piercing the Arctic ice, or penetrating the torrid regions of Africa. Mons. Ernest Desjardins was foremost in the new researches, and had published the first volume of a handsome work, entitled *Gaule Romaine, Geographie, Historique et Administrative*, in which littoral comparisons were given of the forms and dimensions of the coasts from the oldest sources obtainable, often going as far back as the first century of our era. In one particular case Mr. Phene, who had for several years past been examining the coast of northern France unsuccessfully in quest of a place not included in Mons. Desjardin's work, which was only published two years ago, at once searched his work, but to his disappointment found the district he wanted not included in the maps published in the work. However, the broad insight given by Mons. Desjardin's work into the alteration of coast line encouraged him to go on, and calculating by ancient maps the former littoral of this part of France, he soon discovered the island he was in quest of, which was no less a place than Avalon, the reputed place of King Arthur's burial, though from the island having been severed into two by the sea, and the name retained only by the smaller portion, it had been overlooked, and even in the neighbourhood no one knew of it but local fishermen. A dolmen unlike any other in France or Britian on the larger portion, and the traditions of the locality, seemed to put the matter out of doubt.

The PRESIDENT said he had listened with great interest to the remarks of Dr. Phene. The condition of these little internal seas was of very great interest, and the subject was one of much difficulty and complication. The difficulty was of even greater note in such a case as that of the Mediterranean Sea, where there were no definite tides, which occasionally explain the natural phenomena. He did not know that sea himself, except from reading. Dr. PHENE spoke of the wonderful changes which have taken place in various places in the formation of land within comparatively recent times. In some cases the sea wears hollows in the land, in others the land appears to have extended into the sea. Of course these changes were due to a variety of causes, the most influential and marked being geological changes—elevations and depressions.

The next paper read was by Capt. J. WATERHOUSE.

"On Processes of Map-producing by Photography."

The object of the paper was to describe the advantages presented by the use of photography in producing maps; and Capt. Waterhouse explained how perfectly plans, maps, and delicate work of the kind could be by that process reproduced for publication. He entered into a lengthened explanation of the different modes adopted, and said the descriptions must be to a great extent unintelligible without specimens for illustration, and he regretted very much that he had not been able to bring them together for exhibition. By the kindness, however, of the curator of the map collection, he was enabled to show some maps reproduced by the aid of photography.

This paper was followed by one by Mr. E. DELMAR MORGAN,

"On Richthofen, Prejevalsky and Lake Lob."

He said the region on which he proposed to dilate was situated in the midst of the vast plain or depression known to geographers as Central Asia. It was walled in on the south of the great mountain ranges which under different names extend in a direction of nearly west to east, along the 35th or 36th parallel of latitude, across the whole continent from the southern shore of the Caspian Sea to China Proper, and separated from

the Russo-Siberian plain on the north-east ranges of less magnitude, but which in some places attain the limits of perpetual snow, such as the Altai or Tien-Shan.

A brief discussion followed the reading of this paper, and the meeting then adjourned.

Meeting of August 19th 1878.

Sir C. W. THOMPSON in the chair. Capt. R. BURTON read the following paper

"On the Land of Midian."

"To those who read their Bibles," he remarked, "the land of Midian is a household word. 'Vexing the Midianites,' and 'Midianitish women' are familiar sounds. But perhaps you do not know how hazy upon the subject of the grand old land before my trip to North-Western Arabia in the spring of 1877 were the literati, the Press, and the reviewers who lay claim to a few biblical points. For instance, Midianite merchantmen bought Joseph from his brethren and sold him in Egypt. Moses, flying from Pharoah, dwelt in the land of Midian, or the East country, and there married the daughter of Jethro the priest. Despite this alliance, there was war between the kindred peoples, when, led by the great Lawgiver (B.C. 1452), the people burned 'the cities and the goodly castles' of Midian, and carried off a splendid spoil of gold, silver, brass (copper or zinc), tin, iron, and lead, with vessels of gold, chains and bracelets earrings and tablets. After a lapse of two centuries, B.C. 1249, the Midianites again grew powerful, and their revenge upon their terrible kinsmen ended in the second Midianite war. I need hardly tell you how the sword of the Lord and of Gideon slew two kings, with some 135,000 warriors, and won great quantities of gold. After this crushing blow the Midianites fade out of Holy Writ, and you hear of them only in the effusions of Hebrew prophets and poets. It is referred to by ancient historians; and coming down to our modern day, Voltaire, the noble Frenchman who created religious liberty, and who had, *de l'esprit comme tout le monde*, made Midian a 'sandy region which may have contained some villages.' His description of its geographical position was quite erroneous. Later still, some of our popular body changed Midian into Sinai, whilst others knew it not or projected it into impossible places. Even those who had visited the seaboard gave no certain sound. The modern Midianites on the one hand, and the Bedouins who now hold the soil, give a precise geographical definition of its limits, and, as some of them have held it during the days of the Byzantine Empire, I claim high authority for their catholic and constant tradition. The 'Arz Madyan' of the Arabs begins with the fort of Akhabah (N. lat. 29° 28') at the head of the dangerous gulf so named. It extends south to the fort of El Munnylah, and its great watercourse, the Wady Sim (N. lat. 27° 40'). These frontiers absolutely fixed would give the Egyptian province a latitudinal length of 213 miles, which the extensive sinuosities of the coast might prolong to 300, and the depth varies between 24 and 35 miles. The first glance which the voyager casts upon the land of Midian is a sight to be remembered in after years. That majestic scene, at once grand and simple, was right well suited to the heroic race of Bedouins who once held the soil. It reflects to a certain extent the Sinaitic peninsula that faces its shores. However, there is a sharper contrast of the flat and the high, the low and the tall, the horizontal and the perpendicular of the well-watered lowlands, with a luxuriant vegetation of emerald green, and of rolling uplands, sterile as a moon landscape; of the cloud shadows flecking the mountains, and of the serene sky, so remarkable in the regions of downs and plains." Captain Burton gave a glowing description of the first sight of the land of Midian as seen from the deck of the corvette, and described, as from a bird's-eye view of the country, the physical characteristics of the interior and the appearances of the maritime line. He then gave an account of the two expeditions which he commanded to explore the land. Those expeditions were at the sole expense of his Highness the Khedive Ismail I., a prince to whom the future will be more just than the past had been. To the Viceroy alone were they indebted for their present knowledge of this neglected and almost mythical country. In the spring of 1874 his Highness forwarded, in his little steamer 'Erin,' Dr. Charles Beke, who, at the ripe age of 74, gallantly went forth to find "the true Mount Sinai." In the early part of 1877 the Khedive was pleased to place the two expeditions in his (Captain Burton's) charge. The first consisted of a single squad of Egyptian officers and men, with a French geologist, and an English gentleman who acted as commissariat officer and accountant. This preliminary visit lasted little more than a fortnight, but it gave him a fair general view of the country. The second expedition, which was more extensively organised, landed on December 19th 1877. They explored, first, the northern, then the middle, and afterwards the southern district. He described the disused gold and silver mines that were explored, and spoke highly of the wealth of the country as regards these and other metals. He also gave an interesting account of the natives, and of the scenic features of the country. They now knew as much of Midian as he did. Instead of being a mystery, it had become to them a thing of reality. They would join him in lamenting the contrast between what it had been and what it is. Pathetic, indeed, was the view of its desolation. Once the flower of Arabia Felix, it had now become a Petræan desert. The incubus of destruction had sat for centuries on its glorious mountains and luxurious water basins. The wild man, the father not the son, of the wilderness, had done, and was still doing its worst. When the Roman ruled Africa and Propria Numidia, the Regency of Tripolis numbered some 20,000,000 souls; the population, then thick as that of Belgium, was now reduced to 2,000,000. He believed that the Anglo-Turkish Convention placed England, in reference to Arabia, nearly in the same position as that occupied by Rome after the days of Augustus—that a full and perfect faith that Midian will presently awaken from her trance, from her sleep of ages. She offered to the world not a mine, but a mining region some 300 miles long, with an inner depth as yet unknown; and what the ancients worked so well the moderns could work still better. Let them look forward to the development of her mineral wealth under the fostering care of European—and especially English—companies, so they might expect to see the howling wilderness, like Algeria before 1830, become the rich and fruitful province of Algiers in 1878.

The PRESIDENT said they must all feel deeply indebted to Capt. Burton for his admirable paper. When speaking of all that Capt. Burton had done, they should not, however, forget how much he was indebted to Mrs. Burton.

Dr. LEARED then read a very exhaustive paper "*On a Journey to Fez and Mequinez*," which Sir WYVILLE THOMSON followed by one

"On the Progress in the Official Report of the 'Challenger' Expedition."

He said as a period of about two years had now elapsed since the return of the 'Challenger' Expedition, he might reasonably be expected to give some account of the progress which had been made up to the present time in the reduction and classification of the observations which were made in the different departments. The voyage of the 'Challenger,' he observed, had been undertaken for a very definite purpose—the determination of the physical condition of the ocean. While the

ship was at sea their time was entirely devoted to registering observations, and cataloguing, and labelling, and storing specimens. Owing to the great liberality of the Government in supplying abundantly all the necessary materials and appliances, both for procuring specimens and preserving and storing them, an enormous collection has been sent home from time to time in wonderfully good condition. He proposed to the Government that for the present it should be brought together and placed in rooms which were given them for the purpose in the University of Edinburgh, and that for the first year their attention should be chiefly directed to preparing an outline of the general report and going on to the collection, securing its safety, and arranging it as nearly as possible in zoological sequence, and that during this period the services of the scientific staff on board should be retained. He proposed also that as soon as possible arrangements should be made to invite gentlemen who were recognised as authorities in different departments, and who had sufficient leisure at their disposal, to undertake the description of the zoological series, group by group, and that a sufficient sum should be granted to defray the expense of full illustration, and to compensate them to some extent for their expenditure of time. With regard to the destination of the collection, he proposed that, in the first place, each specialist should be requested to set aside all unique specimens, and the most complete series possible of all species of which there were duplicates should be sent to the British Museum. From what he saw at present this difficult report of the voyage of her Majesty's ship 'Challenger' would extend to from fourteen to sixteen quarto volumes of 500 or 600 pages. The whole would be illustrated by about 1200 plates and many woodcuts and photographs. The MSS. of the first volume was nearly completed, and the charts of the ship's course and the sections showing the natural distribution and ocean temperature. The volume in course of preparation would be illustrated by photographs and woodcuts. The second volume would consist chiefly of tables, and would include a report on the magnetic observations made during the voyage, drawn up under the superintendence of the Hydrographer to the navy, and a detailed report on the meteorology prepared by Capt. Tizard. Most of this volume is already in print, and he had there a copy of the magnetic part in proof, and on proof paper, which would give them some idea of the appearance of the book. Another volume would contain the discussion of the nature of the bottom of the sea, the composition and specific gravity of sea water and the composition of its contained gases, and a number of other general matters, and the remainder of the book would be occupied by a series of memoirs by different authors on the various groups of animals which constitute the deep-sea fauna. A large number of these monographs were in progress, and he held in his hand a series of about 150 plates, and they had there the first few of a series of beautiful plates by Mr. Hollick, illustrating mostly the pelagic genera. These plates represented several forms of a remarkable little group, to which they had given the name of the "Challengerida," as they seemed to have hitherto escaped observation. There were probably from 20 to 30 specific forms of these. Next they had a rapidly-growing hill of plates illustrating a splendid memoir on the Radiolaria, by Professor Haeckel. Anyone acquainted with Haeckel's classical work, *Die Radiolarien*, will have some idea of what may be expected of the memoir. The next series of plates represented the deep-sea corals, and were being prepared under the direction of Mr. Moseley, and the next series, also by Mr. Moseley, represented a most remarkable little series of coralloid forms, of the Hydrozoa, which Mr. Moseley had named the Hydrocorallinal, and on their structures and relations Mr. Moseley's careful work during the voyage and since their return had thrown quite unexpected light. The ordinary hydroids are in the hands of Professor Allman, and they had already secured for different departments of the work the services of nearly all the available British artists. Professor Haeckel would describe the few deep water Medusæ which were brought home, and would be found of the highest interest. The Pelmatozoa would be described by himself. About twenty plates were on the stone, illustrating the structure of the stalked crinoid. Professor Alexander Agassiz was going on rapidly with the Echinidea, and his memoir, exquisitely illustrated, would be amongst those first published. Mr. Lyman was working at the Ophiuridea, which, he said, were almost all new; and he expected Mr. Theel, of Upsala, to come over to examine the Holothuridea, which he was going to describe under the general superintendence of Professor Loven.

A paper was afterwards read by Mr. W. H. DALE, "*On the Characteristic Features of Alaska, as developed by the United States' Survey.*"

Mr. J. S. PHENE, LL.D., F.S.A., &c., read a paper "*On the Acquisition of Cyprus, and Observations on Some Islands in the Levant, with References to Recent Discoveries.*"

The author, who had recently made a prolonged and careful voyage of research in the Levant, described the physical features of the islands of Chios, Mytilene, Lemnos, Imbros, Thasos, and Samothrace; the relation of the Cyclades to the great range of Pindus, in lateral off-sets, of which the Cyclades appear to be the summits of former ranges, now (except as to these summits) submerged. Reference was made to the great aqueous stratification in Asia Minor and Southern Thrace, which, being undisturbed, could not (geologically speaking) be remote; and to a remarkable tradition given by Diodorus Siculus that the Euxine had at a far distant period burst its bounds and rushed westward to the Mediteranean Sea, that in this convulsion some of the islands had become submerged, and that the champagne country of the island of Samothrace was permanently so; and that even indications of cities, by the recovery of parts of buildings from the sea, were sometimes made. It was possible, the author thought, that this convulsion represented the sinking down of the mountain ridges, of which the summits were now represented by the various islands stretching south from the several headlands of the Peloponnessus. The author selected Samothrace for ascent, and was, so far as he could learn on the island, the only European, not being a native, who had made the ascent, which was very difficult. He had taken a professedly competent guide from the island of Tenedos, but neither he nor the several natives who first volunteered would make the ascent, and he could only get a mountain shepherd to go with him. The height was only slightly over 5000 feet, but it was the whole climb of this from the sea level, and after 1500 feet of ascent all deserted him but the shepherd. He continued the ascent with the latter, and they surmounted, after great labour, the highest peak, which, from its deeply interesting and extensive view—described by the reader as the most interesting in the Mediterranean—Homer selected as the poetical seat of Neptune to view the fight before Troy. The climates, culture and salubrity of the different islands were dwelt on; Mytilene, from its splendid views of Bergamos, the gulf of Adramytium, and the distant Mount Ida, the rich gardens, good roads and delightful air being, with its splendid and secluded harbours, considered by the author more adapted for British occupation than Cyprus. Chios had also its advantages. Cyprus had a variety of climate, so that the debility produced by the heats in the south could be relieved by a retreat to the northern coast which is cooled by the breezes coming from the Karamanian mountains, while in some inland parts were rich woods abounding with game and objects for the chase. He considered the occupation of Cyprus would open up new sources of commerce on the mainland. It was

interesting to us as being nearer the Holy Land, and curiously enough the only island of note near the coast of ancient Phœnicia. It was also our first acquisition towards the tactics of the ancient commercial nations, both the Phœnicians and the Venetians having occupied Cyprus and all the other islands of which he (the author) had given a description. A number of very curious articles which had been discovered, and which were illustrated by photography, were then described. These opened up the old geographical routes from Samothrace to Britain by coast, and the old road of tin traffic mentioned by Strabo from Britain to the Mediterranean giving examples of recent discoveries of Oriental relics in Britain, Ireland and Gaul.

A vote of thanks was passed to Dr. Phene and the meeting adjourned.

Meeting of August 20th, 1878.

Capt. VERNEY, R.N., in the chair. Dr. J. RAE read the first paper at this meeting

"*On the best Route to attain a High Northern Latitude, or the Pole itself.*"

He reviewed the progress and results achieved by previous polar expeditions referring more particularly to Nares's Expedition. Sailing vessels found difficulty in penetrating beyond latitude 82°, the current being from the north, unless when there was a gale of wind from the south. Calm weather was best for navigating through the ice floes. Arrived at the point reached by Perry, further advance might be made by sledges. Mr. Gordon Bennett, of the *New York Herald* was sending out two ships next year to attempt to reach the Pole, and those expeditions would start from opposite directions, one going by Spitzbergen and the other by Behring Straits; and so, perhaps, they might meet at the Pole. Admiral Richards in a letter to the *Times* had said he would not be surprised to see Captain Adam, of whaling notoriety, go in his Arctic ship right through Smith Sound and out at the other side. But the speculation was made before Nares saw the ice. Previous to his expedition a very great many very wild notions were expressed by men who ought to know better. It was a mistake to say that there was not the least difficulty in going to the Pole with sledges, as was apparent to men who studied anything about Arctic surveying. It should be borne in mind that the journey was about 1400 miles. Sir Leopold M'Clintock, had done good service among the Parry Islands, using sledges with great advantage, but he did not go beyond 500 miles from his ship. Dr. Rae's object was to show that a broad channel was a better route to reach a high northern latitude than the narrow channels such as Smith Sound, which had been tried, because in the narrow channels, though leading northward, the ice almost invariably impinged on one point or another, influenced by the action of winds or currents, or both combined. The danger of navigating narrow channels was illustrated by the loss of no less than nine ships, including those of Parry, Franklin, M'Clure, Belcher, and Hall. Whilst the attempts made to reach a high northern latitude by Smith sound had been made by Nares, Hall, and Kane in steam-vessels, no properly equipped steam ships had ever attempted, as far as he knew, to push to the north along the west coast of Spitzbergen. The German expeditions that went in that direction crossed to the eastern coast of Greenland, where, as Arctic explorers knew, there was a constant stream of closely-packed floe ice driving southward, not a bit of which passed to the eastward of Iceland. Therefore, he considered it essential for a fair test of the Spitzbergen route to have a properly-equipped steamship sent in that direction, because here, if anywhere, steam power was requisite, owing to the constant drift already mentioned. The thick ice spoken of by recent explorers, instead of being a danger to a ship, was rather the reverse, as, by drawing much more water than the ship did, she found an easy passage between the ice and the sea.

The next paper was by Dr. MOSS, "*On the Geographical Significance of the North Polar Ice*," which was followed by Mr. J. STEVENSON by one

"*On Livingstonia.*"

He stated that the object most prominently in view in founding settlements in the interior of Eastern Central Africa was the Christian civilization of the natives. The special means to be used to this end was the introduction of industrial missions, which had been tried with success among the cognate tribes of Southern Africa. To prove the success with which the Kaffir tribes had been dealt with he need only quote from the despatches of Sir Bartle Frere, addressed to Her Majesty's Secretary of State for the Colonies, in which he says "that nothing would do more to prevent future Kaffir wars than a multiplication of institutions like those of Lovedale and Blythswood." In selecting a position in Central Africa (Eastern) where the experiment should be tried, various considerations present themselves. The Nyassa region had the advantage of being accessible by the only considerable rivers of Eastern Africa, and the attempts of Livingstone to place steam-vessels on those rivers had been so successful as to indicate that such a mode of transit offered no physical obstacles likely to be insuperable. On the other hand, the obstacles which might be placed in their way by the policy which had hitherto characterised the Government of the Portuguese provinces rendered it very doubtful whether any advantage could be derived from the existence of those rivers in doing anything considerable in opening up the country. Trusting that the Portuguese would see that the opening up of the country would be of real advantage to them as well as to the natives, we decided to place our settlement behind their provinces. The immediate results in establishing the settlement were eminently discouraging, for a hostile tariff was issued and the exclusive right of steam navigation on the rivers of Zambesi and Shire was offered to a Portuguese subject, the concession being for thirty years. While saying this they must acknowledge the liberality of the Portuguese in remitting the duties chargeable on the goods sent for consumption of the first mission party, although it was not continued on the second year. The slave trade, under treaty obligations, terminated in 1877, and domestic slavery was abolished somewhat earlier. General interest came to be taken in the details of African misery, and their responsibility for the unhappy state of that quarter of the globe was brought before the Portuguese legislature. No one who had read the debate which subsequently took place in the Cortes could avoid the conclusion that the tone of the discussion was creditable to those who took part in it. Their feeling was that the honour of the country should not be responsible for what had happened in regions where it had no real control. Having discussed the questions of the tariff and the concession of exclusive steam navigation Mr. Stevenson described at length the navigation between the Zambesi and Lake Nyassa, describing also the lower and upper Shire valley and the manners and customs of the tribes inhabiting that region. After further dealing with the subject of the undertaking to promote the civilisation of South-Eastern Africa, mentioning many interesting facts, Mr. Stevenson concluded by stating that, through the kindness of the Governor-General in Council at Madras, Wardian cases, containing plants of chinchona, tea and coffee had been sent to Livingstonia and Blantyre, along with an assortment of various seeds. He also pointed out the necessity of pursuing geographical research with due reference to its most important ends.

Major WILSON afterwards read a paper

"*On Cyprus.*"

In the course of his interesting observations, he said that each year had seen the vineyards of Cyprus run to

waste, cultivation decrease, and a hopeless state of despondency settle down on the people, until at last the most beautiful and fertile of islands had become in parts almost a desert. For years the land had lain fallow, but with the influx of British capital and energy the island was capable of again becoming the garden and granary of the East. A very short time would see the plain again covered with golden corn, but to replace the vineyards, the olive groves, and the forests, which were once the glory of Cyprus, would require time. Major Wilson then gave the extent of the island, which he said was chiefly occupied by two mountain ranges, having a general east and west direction. He also described its geographical formation, mentioned the heights of its mountains, and the position and character of its valleys. He mentioned that there were three separate peaks—the highest being about 6160 feet; there were no vines on the summit, which was quite bare, the rock being broken up by the action of the weather. A short distance down the mountain is the large monastery of Troodissa. The level ground is covered with gardens and fruit trees, the valleys are green with pasture land, whilst along the coast line one village follows another in quick succession. It is the richest part of the island, and the fresh sea breezes from the north, and the numberless rapid streams from the mountains make it the healthiest. There are no good natural harbours. The chief places of trade at present are only open roadsteads. Salamis and Famagusta were artificial harbours; the latter could easily be made a good one. Tyrinia, on the north coast, was a very small and bad port, but the only one on that side of the island. Larnaca, which is built on the site of ancient Citium, now the chief place of trade, and contains 5000 or 6000 inhabitants. Limasol is the principal export town for wine. Paphos, the residence of Sergius Paulus, where Elymas was struck with blindness, is celebrated for the worship of Aphrodite or Venus, who was fabled to have there risen from the sea. Salamis was called by the Greeks a good harbour—Jews had synagogues there. The population of the island is about 144,000, of whom 44,000 are Moslems. The Cypriotes are dull and stupid, but are very docile and sober, and their love of home and family is a most favourable trait in their character. The Cyprian peasants themselves have so little skill and forethought that the most careful Government would have some trouble in getting them to work harder and more intelligently. "Cyprian ox" was the term of old used to describe this race, so stubborn, so wanting in intelligence, and, even at the present day, the true Cypriote squats in his native village surrounded by filth, sticks to his ancient habits, and goes no further than he can help. The climate had been affected by many causes. The forests, which were the glory of the island, had disappeared. During the period of the Turkish rule everyone cut down what he wanted, no one ever thought of re-planting. The poorer the people became the more the forests disappeared, and the finishing touch was given by Mehemet Ali, who cut down nearly every tree, partly for sale, partly for shipbuilding, partly for use in Egypt. When the people were asked about the disforesting they said, "It has always been so in our country," and when the consequences were pointed out they said, "The Government wishes it;" so accustomed were they to abuse the Turks for their own shortcomings. The climate was good, but there were fevers just such as attacked visitors to Malta, which lasted only two or three days. Near the end of the great plain there were large swamps into which the rivers divided themselves, and were thus prevented from reaching the sea. He recommended the introduction to Cyprus of the eucalyptus, or Australian gum tree, a plant which had the effect in swampy districts of producing beneficial results, as was the case in Algeria. It was also the only green plant which after it had grown for one year locusts did not attack, because of its astringent properties. This was also the more important because the island was sometimes visited by a plague of locusts. There were also seasons of great drought, but the heavy dews might be said to a great extent to counteract their effect. As to the mineral products, Major Wilson mentioned that copper mines had been extensively worked in the island by the Romans. The principal ones were situated near Tamassus, about three hours' ride from Dali (Idalium). Coal, or shale, had been found near the ancient Soli. Besides copper, Strabo mentioned that the island produced silver, and Pliny records the existence of precious stones, probably rock crystal. In saying that light fevers attacked those who visited the island, he did not wish to convey that the climate was what could fairly be described as unhealthy. It arose from the absence of so much wood, and from the circumstance which he had described, which prevented the rivers reaching the sea. It would also occur to them that the place could scarcely have been unhealthy when the Greeks adopted it for the worship of Venus. He hoped that they would not be led by their aquisition of Cyprus into a military Government. There was no occasion in Cyprus for the employment of a large number of troops. The number employed by the Turks was exceedingly small, and did not exceed half a regiment, and the most of the soldiers used were a sort of militia raised in the island, who never went beyond its limits. He hoped that one of the first things that the Government would do would be to send over a properly organised scientific expedition to survey the island. They had no proper topographical survey. The maps they had were by different itineraries who had crossed the island from different directions. They had no scientific map of the mines either, and he thought a geological survey should be also made, for he thought they would find in the limestone rocks cave deposits. The whole country required to be excavated, for there must be a great number of inscriptions there which must be most valuable. As an instance of what might be discovered he mentioned the bilingual inscription in Phœnician and Cypriote upon marble found by Mr. Lane at Dali, the ancient Idalium, in the British Museum, and the discovery by Mr. Lang, British Consul at Cyprus, and the late Mr. G. Smith, the lamented Assyrian scholar, or word king. He had no doubt that the energetic High Commissioner, Sir Garnet Wolseley, would so deal with the administration of the country that in a few years Cyprus would set an example to the whole country of rich produce; and he would like to see the old castle of Buffamento some day the seat of the High Commissioner of the Island of Cyprus.

Sir RAWSON RAWSON congratulated the section on the fact that a gentleman so well acquainted with Eastern life, and whose fame was world-wide, because of his experience in the excavations in Jerusalem, should have treated this subject. As to the question of fever in Cyprus, there was not a single colony in her Majesty's possession in which a new-comer was not generally stricken down by fever. It was commonly called colonial fever, and it lasted for two or three days or a week, and left no traces behind. It attacked the inhabitants of islands in the West Indies who went to visit other islands in the same region. Therefore, let those who had friends in Cyprus think nothing of what they read—it was the mere natural effect of the change from one temperature to another. The absence of rains need not alarm them, as the dews supplied the moisture of the soil that was necessary. He regarded the acquisition of Cyprus as one of the most glorious exertions of the present generation, which might be the means of regenerating, not merely the whole of Cyprus, but vast territories in Europe and Asia. They would then be able to value that great achievement the more by the light of the information which they had received from Major Wilson.

The PRESIDENT said, as a naval man, he had studied the chart of Cyprus in order to get what information he could. He had been greatly struck with the absence of

harbours, as far as he could see, and of the great difficulty in making new harbours. This objection had been made against Cyprus many times, but they were met with the observation that the harbours could be made. That, however, was a general observation. If they wished to put as much money into the sea as made Holyhead breakwater they could have breakwaters; but the question was whether that would be worth the money. His opinion was that it could not be done; but he spoke with great diffidence, and with small knowledge except what was taken from the chart. He did not himself see how they were at a reasonable cost to make a harbour at Cyprus that would be of real use to the country.

The last paper read at the section was by Mr. A. BURRELL, M.R.A.S., F.S.S.,

"*On the Geographical Distribution of the Tea Plant.*"

Tea, as a beverage (Mr Burrell observed) was known in Europe in the beginning of the sixteenth century, became a regular article of consumption in the seventeenth, formed one of the largest imports from China in the eighteenth, and was now the special beverage of all English-speaking peoples, both in the New World and the Old. The botany, method of culture, and modes of manipulation were, however, little known here till about forty years ago. The Jesuit missionaries in China and Japan were our first informants of the virtues of tea. The Portuguese and the Dutch, who, long before our East India Company was established, traded with these countries, introduced it commercially to Europe, and there was evidence of its use in England in 1610, during the reign of James I. Dr. Johnson was quite wrong in dating its introduction after the Restoration, for it was in common use during the Commonwealth, and the first Act of Parliament when the "King came to his own again" was passed to levy a heavy duty on tea. Oliver Cromwell's teapot, which the elder Disraeli had heard of, had now turned up, and there was no doubt but it was a favourite beverage of the Round Heads, and so hated by the Cavaliers, who were more given to wine and other potent liquors. The tea plant at first reached Europe in 1763, when the great botanist Linnæus received a seedling which, however, notwithstanding the most assiduous care, soon perished. The earliest plant that had really flowered and produced seed was at Zion House, near London, in 1768. In China the plant was in common use from the seventh century; in Japan from the eighth. It grows in these countries up to 42° of North latitude, and was capable of being grown as far of Sou'h latitude, though the best tea is produced in China between 27° and 30° North latitude. Up to the first quarter of the present century all the tea consumption of the world was supplied from China, with a very little from Japan. In 1827 the culture was introduced by the Dutch in Java, and has ever since proved a successful undertaking. In 1834, immediately after the abolition of the East India Company's monopoly of trade to the East, tea was introduced from China into India, not at first becoming a profitable business. But next year the plant was discovered growing wild in Assam. Mr. Burrell here described the history of this important discovery, and paid a well-merited compliment to Dr. M'Clelland the only survivor of the group of eminent men, scientific and practical, who inaugurated what has since proved to be one of the greatest staple industries of India. Tea, both from the China plant and from this Assam kind, was now grown throughout all India, and with the result that, for variety of strength, pungency, and flavour, our great dependency was now producing tea which China in her more palmy days, and less so than ever now, could not rival, and that, great and growing as the demand was, India throughout the vast extent and variety of her soils and climates, was destined to be the great tea producer of the future. He adverted to the fact that, beginning with a production of only four pounds in 1840, she now sent into this country forty millions of pounds—as great a quantity as was consumed in the whole of the United Kingdom in 1837. The author then took up the distribution of the tea plant in other countries. These were:—In Asia: the Corea, Tonquin, Cochin China, Annam, Ava, and Burmah, where the tea plant was cultivated to some extent, but only for native consumption. It had been introduced to Brazil in 1827. The French had attempted its cultivation in 1841. It was now growing in Mauritius, the Isle of France, St. Helena, at Singapore, in Ceylon, and our Australian Colonies. In the West India Islands it had also been recently introduced, and the last year's report of Kew gave a good account of its condition in Jamaica. Nor had our American cousins neglected it. They had sent to China in 1857 for plants, and tried the culture near Washington, in Virginia, and Carolina: quite recently they have tried it in California, and near Baltimore. Lastly, Mr. Burrell took up the question of the original home of the tea plant. In Japan it was admitted on all hands not to be indigenous. In China it was long held to be native to the soil, but more recent researches have thrown doubt on this point, and the balance of evidence seems to point to the Assam Valley of India, along the course of the Brahmahputra, as the original seat of the plant. This is supported by the fact that, while in China the tea plant is never found thoroughly wild away from man's habitation, and is more of a bush than a tree; in Assam, on the other hand, and in the hill ranges surrounding that valley, it is found everywhere growing wild, and attaining great height as a tree, usually fifteen to twenty feet high, and even by a report just received from India, sixty to eighty feet high, and of the girth of three to four feet, among the secluded Naga hills. Mr. Burrell concluded by citing a long list of authorities—from Marco Polo and his learned editor Colonel Yule, the Jesuit missionaries, and more recent travellers, down to the quite recent works of Richthofen, Margary, Baber and Gill, all tending to show throughout the vast stretch of country intervening between the frontiers of India and China, and on either side, evidence of the tea growing wild, and constantly of smaller dimensions as it approached to China, thus affording ground for his contention, which was further supported by the legends of China and Japan, that the tea plant was introduced there by a Buddhist missionary from India.

A discussion ensued, in which Sir GEORGE CAMPBELL, M.P.; E. W. COOKE, R.A., F.R.G.S.; Mr. MARCUS MOSES, and other gentlemen took part.

A vote of thanks to the Secretaries closed the business of the section.

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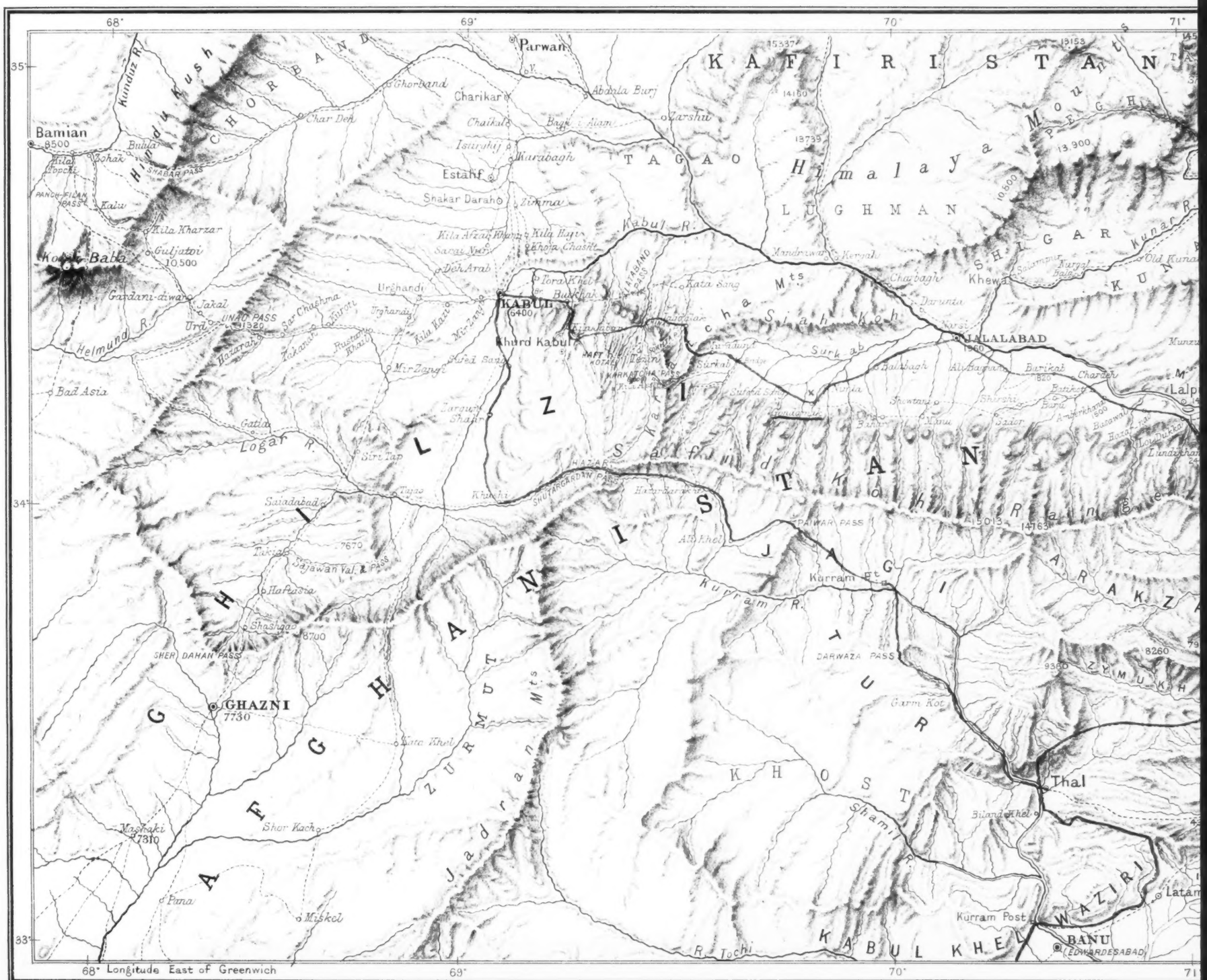

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